MICROSCAN

QX Hawk Industrial Imager User's Manual

P/N 83-006800 Rev A

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Disclaimer

The information and specifications described in this manual are subject to change without notice.

Latest Manual Version

For the latest version of this manual, see the Download Center on our web site at:
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Technical Support

For technical support, e-mail: **helpdesk@microscan.com**.

Warranty and Terms of Sale

For Standard Warranty information, see: **www.microscan.com/warranty**.

Microscan Systems, Inc.

Renton Headquarters
Tel: 425.226.5700 / 800.251.7711
Fax: 425.226.8250

Nashua Office
Tel: 603.598.8400
Fax: 603.577.5818

Microscan Europe
Tel: 011 31 172 423360
Fax: 011 31 172 423366

Microscan Asia Pacific
Tel: 65 6846 1214
Fax: 65 6846 4641

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About the QX Hawk Industrial Imager

The key features of the QX Hawk Industrial Imager are:

- Fully integrated liquid lens technology, allowing infinite focus flexibility
- High-resolution modular optical zoom system
- Simple plug-and-play connectivity with Ultra-Lock™ cordsets and connectors
- Best-in-class X-Mode™ algorithms
- Embedded Ethernet TCP/IP
- A green flash (visible from all angles) to signal a successful read
- LED array for performance, communication, and I/O user feedback
- EZ Button for setup and testing
- Compact size for easy integration into a wide variety of applications
- IP65/67 enclosure

Imager Communication

There are three ways to configure and test the QX Hawk:

- Microscan's Windows-based **ESP Software** (Easy Setup Program), which offers point-and-click ease of use and visual responses to user adjustments.
- Serial commands, such as **<K100,1>**, that can be sent from **ESP**'s **Terminal** or another terminal program.
- The **EZ Button** on the top of the imager.

"Ultra-Lock" is a trademark of Woodhead (Molex).

Warning and Caution Summary

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

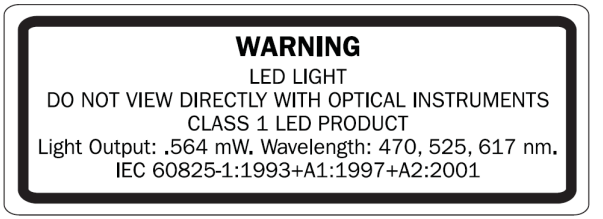
- Reorient or relocate the receiving antenna;
- Increase the separation between the equipment and receiver;
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected;
- Consult the dealer or an experienced radio/TV technician for help.

For connection to a UL-listed direct plug-in power unit marked Class II and rated 10 to 28 VDC at 5 watts or greater.

European models must use a similarly rated Class I or Class II power supply that is certified to comply with standard for safety EN 60950.

Use of controls, adjustments, or performance of procedures other than those specified herein may result in hazardous LED light radiation exposure.

There are no user-serviceable parts in the imager. Opening the imager voids the Microscan Systems, Inc. warranty.



Statement of Agency Compliance

The QX Hawk has been tested for compliance with FCC (Federal Communications Commission) regulations and has been found to conform to all applicable FCC Rules and Regulations.

To comply with FCC RF exposure compliance requirements, this device must not be co-located or operate in conjunction with any other antenna or transmitter.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The QX Hawk has been tested for compliance with CE (Conformité Européenne) standards and guidelines, and has been found to conform to applicable CE standards, specifically the following requirements:

General Immunity for Light Industry: EN 55024:1998 ITE Immunity Standard

Radiated and Conducted Emissions of ITE Equipment: EN 55022:98 ITE Disturbances

The QX Hawk has been tested by an independent electromagnetic compatibility laboratory in accordance with the applicable specifications and instructions.

Statement of RoHS Compliance

All Microscan readers with a ‘G’ suffix in the FIS number are RoHS-Compliant. All compliant readers were converted prior to March 1, 2007. All standard accessories in the Microscan Product Pricing Catalog are RoHS-Compliant except 20-500013-01 and 98-000039-02. These products meet all the requirements of the European Parliament and the Council of the European Union for RoHS compliance. In accordance with the latest requirements, our RoHS-compliant products and packaging do not contain intentionally added Deca-BDE, Perfluorooctanes (PFOS) or Perfluorooctanoic Acid (PFOA) compounds above the maximum trace levels. To view the documents stating these requirements, please visit:

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0095:EN:HTML

and

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:372:0032:0034:EN:PDF

Please contact your sales manager for a complete list of Microscan’s RoHS-Compliant products.

This declaration is based upon information obtained from sources which Microscan believes to be reliable, and from random sample testing; however, the information is provided without any representation of warranty, expressed or implied, regarding accuracy or correctness. Microscan does not specifically run any analysis on our raw materials or end product to measure for these substances.

The information provided in this certification notice is correct to the best of Microscan’s knowledge at the date of publication. This notice is not to be considered a warranty or quality specification. Users are responsible for determining the applicability of any RoHS legislation or regulations based on their individual use of the product.

1 Quick Start

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This section explains how to set up and test the QX Hawk quickly using **ESP** (Easy Setup Program). Detailed setup information for installing the imager into an application can be found in subsequent sections.

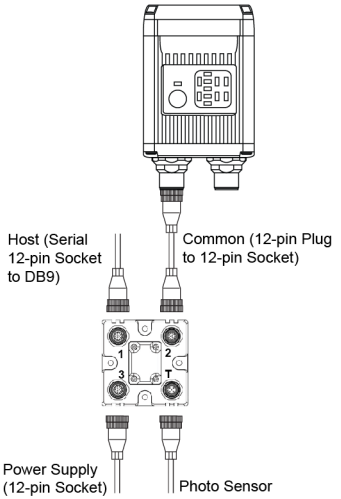
Step 1 — Check Hardware

Item	Description	Part Number
1	QX Hawk Industrial Imager	FIS-6800-XXXXG
2	QX-1 Interface Device	98-000103-01
3	QX Cordset, Common, M12 12-pin Plug to M12 12-pin Socket, 1 m	61-000162-01
4	QX Cordset, Host, Serial, M12 12-pin Plug to DB9, 1 m	61-000152-01
5	QX Cordset, Host, Serial, M12 12-pin Socket to DB9, 1 m	61-000153-01
6	QX Power Supply, M12 12-pin Socket, 1.3 m	97-000003-01
7	QX Cordset, Host, Ethernet, M12 8-pin Plug to RJ45, 1 m	61-000160-01
8	QX Photo Sensor, M12 4-pin Plug, NPN, Dark On, 2 m	99-000020-02

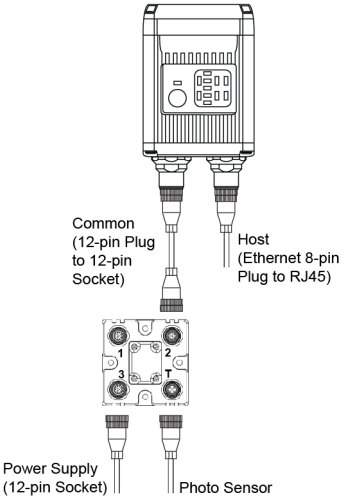
Note: Additional cordsets and accessories are available in the Microscan Product Pricing Catalog.

Note: The QX Hawk does not require an Ethernet crossover cordset, because the imager itself performs automatic internal crossover (transmit-to-receive switching). Microscan offers a standard straight-through (un-crossed) Ethernet cordset (61-000160-01).

Important: Do not attempt to power more than four imagers with a single power supply in a daisy chain configuration. Add a QX-1 and one power supply for every four additional imagers in the daisy chain.



Serial Standalone (with QX-1)



Ethernet Standalone (with QX-1)

Hardware Required

Caution: Be sure that all connections are secure **BEFORE** applying power to the system. Always power down **BEFORE** disconnecting any cables.

Step 2 — Connect the System

Important: When connecting Ultra-Lock cordsets to the QX Hawk and QX-1, align the pins first and then push the connector into place. Do not twist the connectors, as this will bend the pins.

Important: Do not attempt to power more than four imagers with a single power supply in a daisy chain configuration. Add a QX-1 and one power supply for every four additional imagers in the daisy chain.

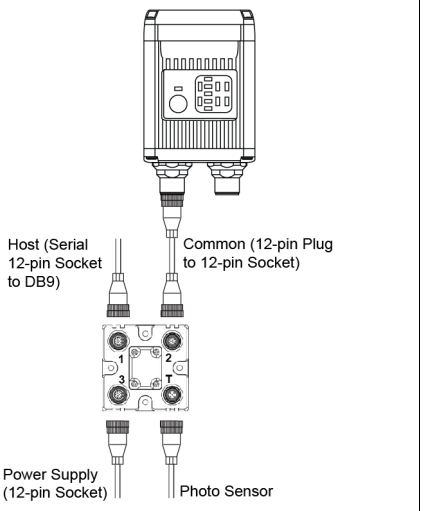
RS-232

- Connect the Serial Communication Cable from “A” on the QX Hawk to “2” on the QX-1.
- Connect the host cable from “1” on the QX-1 to the host computer.
- Connect the photo sensor to “T” on the QX-1.
- Connect the power supply to “3” on the QX-1.
- Plug in the power supply.

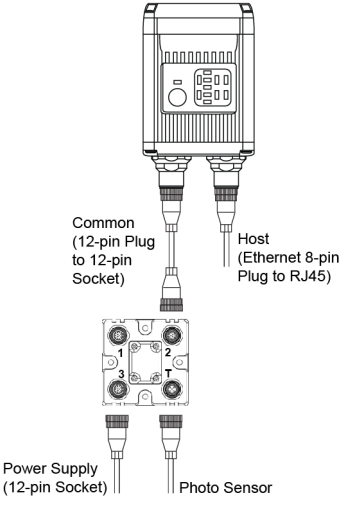
Ethernet

Note: The QX Hawk does not require an Ethernet crossover cordset, because the imager itself performs automatic internal crossover (transmit-to-receive switching). Microscan offers a standard straight-through (un-crossed) Ethernet cordset (61-000160-01).

- Connect the Ethernet Cable from “B” on the QX Hawk to the network.
- Connect the photo sensor to “T” on the QX-1.
- Connect the power supply to “A” on the QX Hawk.
- Plug in the power supply.



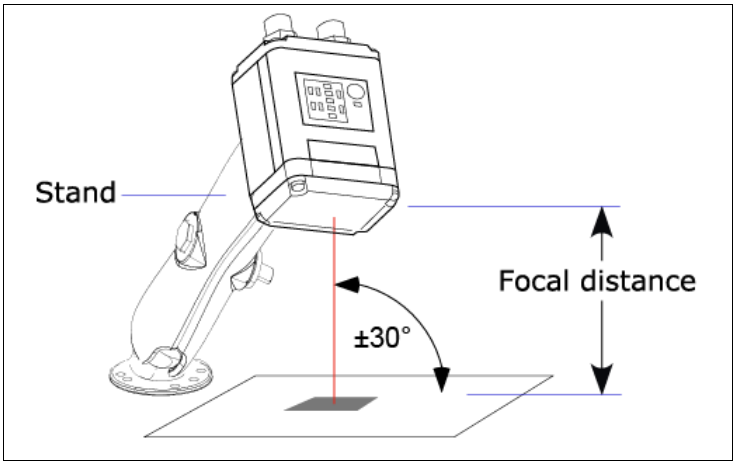
Serial Standalone (with QX-1)



Ethernet Standalone (with QX-1)

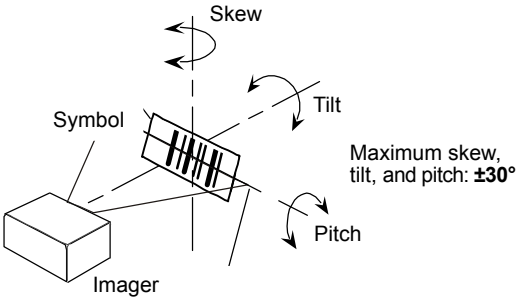
Step 3 — Position the Imager

- Position the imager at a focal distance of one inch or more from a test symbol.
- Tip the imager relative to the symbol to avoid the glare of direct (specular) reflection. The case parting line should be perpendicular to the plane of the symbol by either pitching the symbol or the imager as shown.
- Symbols can be rotated (tilted) at any angle; however, for best results symbols should be aligned with the field of view. In the case of linear symbols, aligning the bars in the direction of their movement (ladder orientation) will minimize the chances of blurring and will result in more consistent decodes.



Imager and Symbol Orientation

Important: Avoid excessive skew or pitch. Maximum skew is **±30°**; maximum pitch is **±30°**. The illustration below shows skew axis, pitch axis, and tilt axis.



Step 4 — Install ESP

ESP Software can be found on the Microscan Tools CD that is packaged with the QX Hawk.

1. Follow the prompts to install ESP from the CD.
2. Click on the ESP icon to run the program.

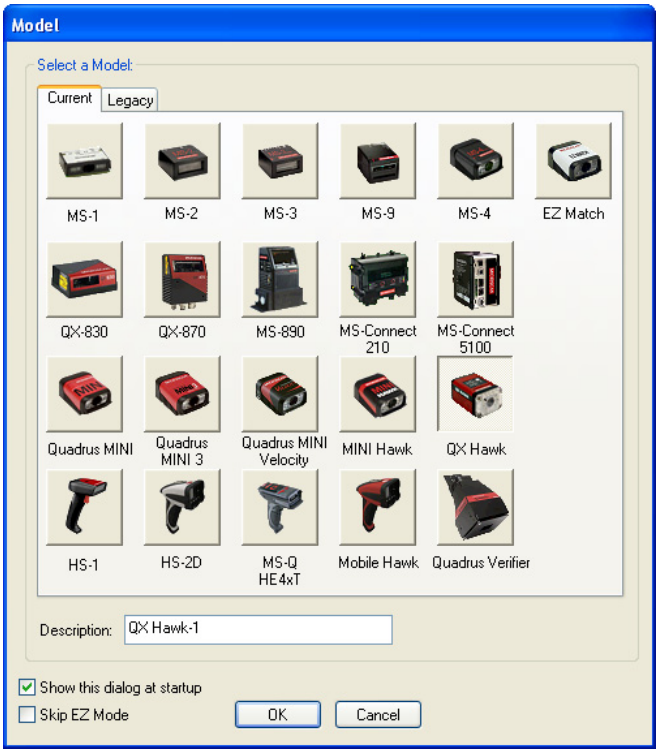
Note: ESP can also be installed from the **Download Center** at **www.microscan.com**.

Minimum System Requirements

- 166 MHz Pentium processor (Pentium II processor recommended)
- Windows Vista, XP, or 2000 operating system
- Internet Explorer 5.0 or higher
- 64 MB minimum RAM (128+ MB RAM recommended)
- 80 MB hard drive space
- 800 x 600 minimum 256 color display (1024 x 768 32-bit color recommended)

Step 5 — Select Model

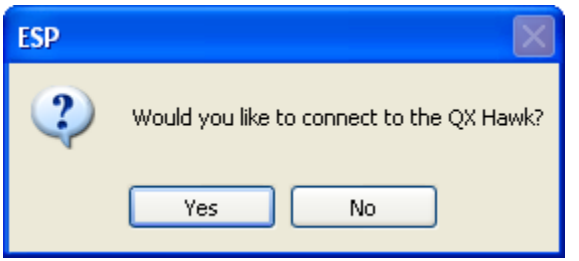
When you start **ESP**, the model menu will appear:



1. Click the button showing the QX Hawk.
2. Click **OK**.

   Note: You can also simply double-click the button showing your imager to make your selection.

3. Click **Yes** when the following dialog appears:



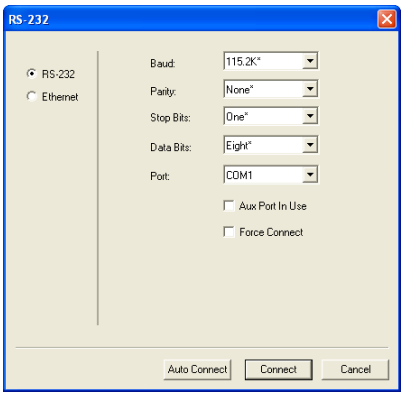
Note: If you need to select another model later, click the **Switch Model** button near the top of the screen or use **Model > New Model** in the menu toolbar.

Step 6 — Connect

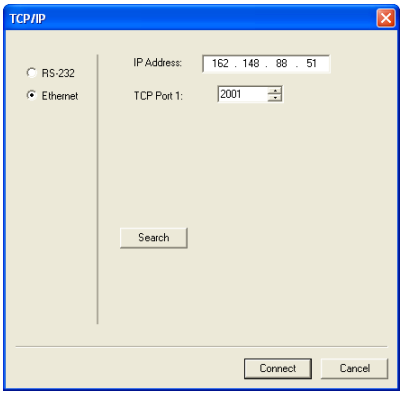
Connection Wizard

To connect using the Connection Wizard:

- Click **Connect** on the menu toolbar, and then select **Connection Wizard**.
- Select **RS-232** or **Ethernet** to activate the appropriate display.
- Configure settings as required by the application, and click **Connect**.



RS-232 Connection Wizard



Ethernet Connection Wizard

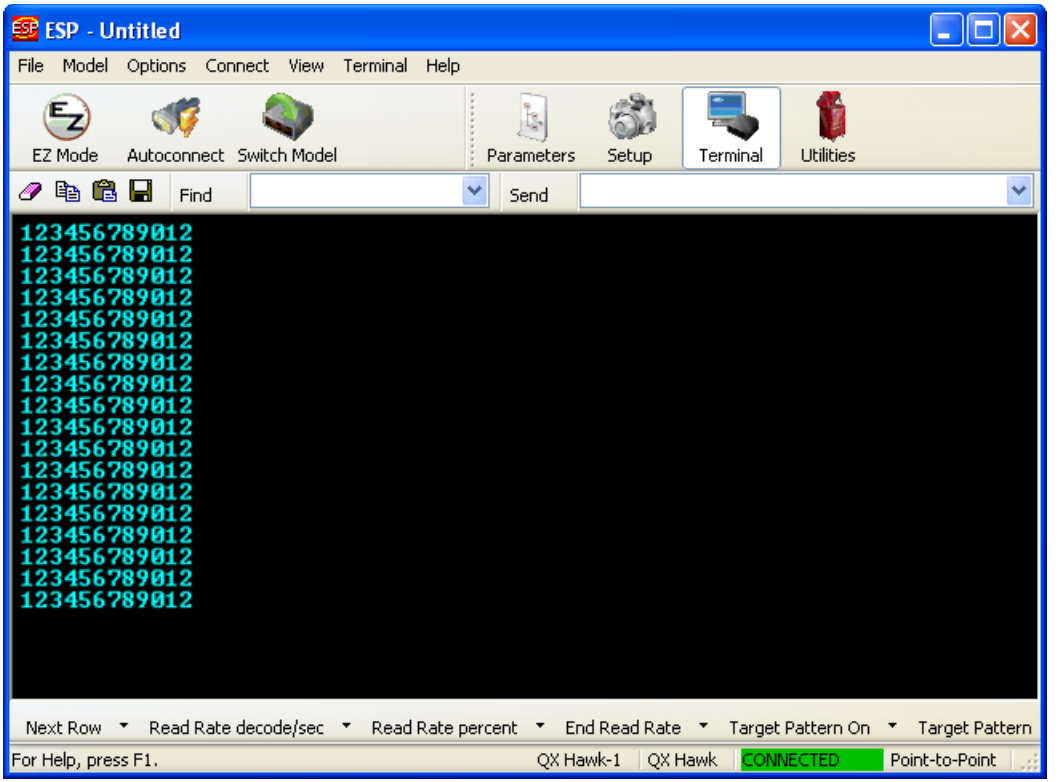
- When a connection is established, the green indicator in the status bar at the bottom right of the screen will be visible:

Important: The imager is in **Continuous Read Mode** by default. For best connection results, be sure that no decodable symbols are within the imager's field of view while attempting to connect.

Step 6 — Connect (cont.)

Ethernet TCP/IP

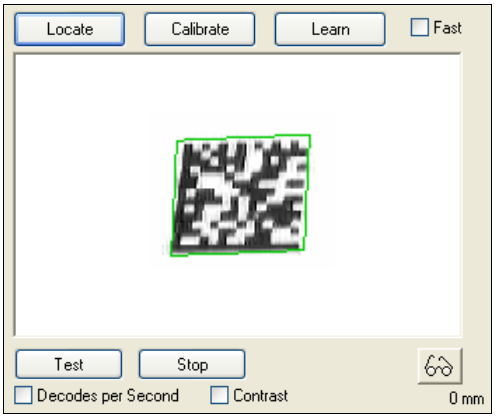
Once the QX Hawk is connected, incoming symbol data can be displayed in the **Terminal**, as shown below.



Step 7 — Locate Symbol

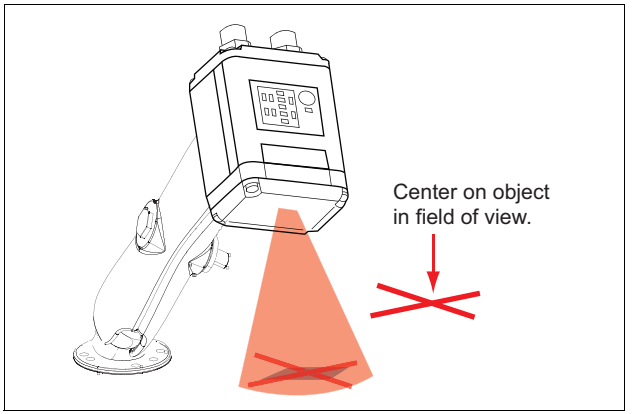
Locate by ESP

- In **ESP**'s **EZ Mode**, click the **Locate** button to enable the red **X** pattern.



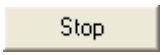
The symbol in the field of view will appear in the video view beneath the **Locate** and **Calibrate** buttons, and you will see the red target pattern projected from the front of the imager.

- Center the target pattern on the symbol.



Important: The entire symbol should fall within the field of view (FOV) of the imager. The field of view is what appears in **ESP**'s **Locate/Calibrate** window in **EZ Mode**.

- Click the **Stop** button to end the **Locate** function.



Locate by EZ Button

If you are not connected to a host computer, the **EZ Button** allows you to locate a symbol in the imager's field of view.

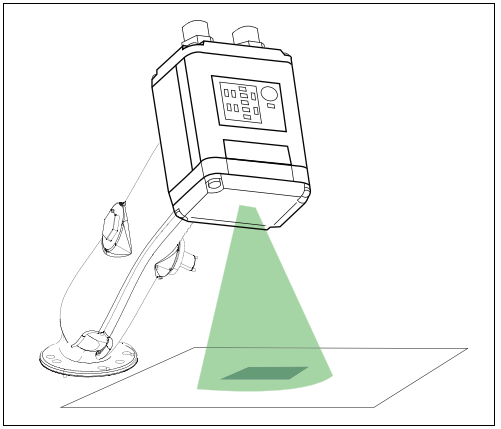
- Hold down the EZ Button for about one second and release when you hear one short beep. The amber **20%** LED will illuminate, and you will see the red target pattern projected from the front of the imager.
- Center the target pattern on the symbol.

Note: To end all EZ Button functions, press the EZ Button once and quickly release.

Step 8 — Calibrate

Imager settings can be adjusted automatically for optimum performance by either the EZ Button or by **ESP**.

During the calibration routine, the imager will flash its amber Read Rate percent LEDs and illumination LEDs while searching camera settings and determining the best configuration for decoding symbol data. Upon successful completion of this routine, a green LED pattern will flash brightly and illuminate the symbol. If unsuccessful, the imager will emit 5 short beeps and stop searching.



Calibrate by ESP

1. Click the **Calibrate** button.

2. The imager will search camera settings to determine the best configuration for decoding symbol data.

   A successful calibration will display a green frame around the symbol, and the following message will appear: “Uploading all reader parameters.” After a moment the symbol data will be presented in the field below the image display window.

Calibrate by EZ Button

1. Hold down the EZ Button for about two seconds and release when you hear **two short beeps**. The **20%** and **40%** LEDs will illuminate.
2. The imager will search camera settings to determine the best configuration for decoding symbol data.

   Note: To end all EZ Button functions, press the EZ Button once and quickly release.

Calibrate by Serial Command

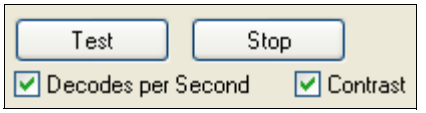
Send **<@CAL>** from a terminal program to begin auto-calibration.

Step 9 — Test Read Rate

Read Rate indicates the number of successful decodes per second achieved by the imager.

Test Read Rate by ESP

1. Click the **Test** button to start the **Read Rate** test.



   If a symbol has been successfully decoded, its data and related information will be presented in the field below the image display window. While the symbol is being decoded, the Read Rate LEDs will indicate the corresponding read rate percentage on the top of the unit.

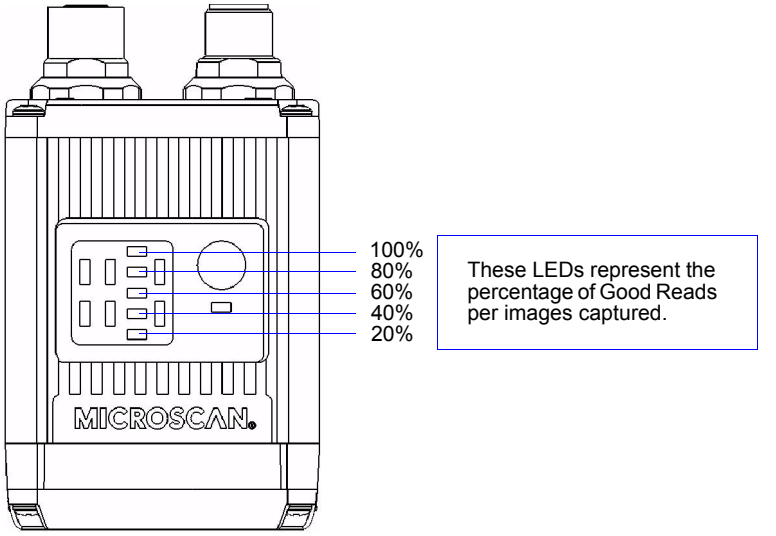
2. Click the **Stop** button to end the Read Rate test.

   Note: Read rate can also be tested using the **Read Rate** interface in **Utilities**.

Test Read Rate by EZ Button

1. To start the Read Rate test, hold down the EZ Button about three seconds until you hear **three short beeps**. The **20%**, **40%**, and **60%** LEDs will illuminate.

   While the symbol is being decoded, the Read Rate LEDs will indicate the corresponding read rate percentage on the top of the unit.



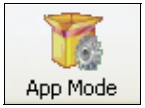
2. To end the Read Rate test, press the EZ Button and quickly release.

Test Read Rate by Serial Command

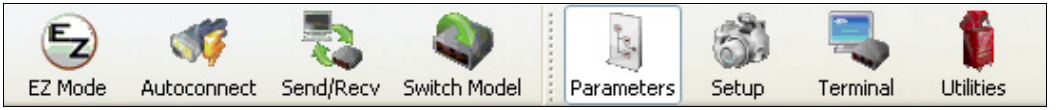
You can also start a test with the **<C>** or **<Cp>** command and end it with the **<J>** command.

Step 10 — Configure the Imager

Click the **App Mode** button to make configuration changes to the imager.

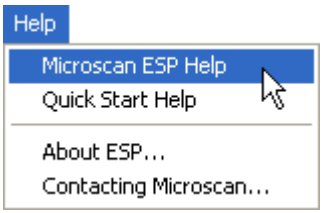


The following modes are accessible by clicking the buttons at the top of the screen:



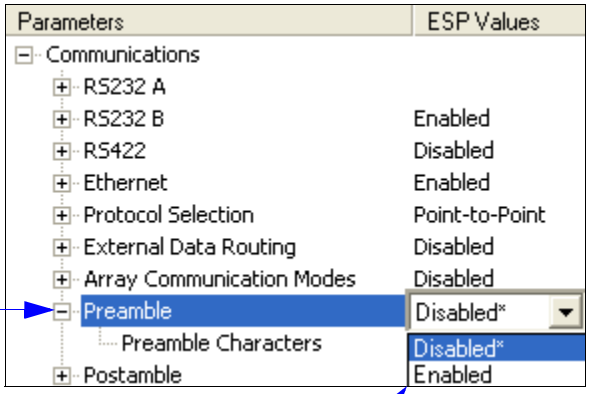
- Click the **EZ Mode** button to return to EZ Mode.
- Click the **Autoconnect** button to establish communication.
- Click the **Send/Recv** button to send or receive commands.
- Click the **Switch Model** button to open the model menu, or to return to a previous model.
- Click the **Parameters** button to show the tabbed tree controls for Communication, Read Cycle, Symbologies, I/O Parameters, Symbol Quality, Matchcode, and Diagnostics.
- Click the **Setup** button to access the Camera Setup tree control and the tabbed interfaces for Video, Evaluation, Calibration, Window of Interest (WOI), Configuration Database, Ordered Output, Output Format, and Dynamic Setup.
- Click the **Terminal** button to display decoded symbol data and to send serial commands to the imager using text or macros.
- Click the **Utilities** button to show the tabbed interfaces for Read Rate, Counters, Device Control, Differences from Default, Master Database, and Firmware.

For further details, see **ESP Help** in the dropdown Help menu.



Step 11 — Save Changes

To make changes to configuration settings in the tree controls:



1. **Left-click** on the **+** to expand the desired tree.
2. **Double-click** on the desired parameter and click once in the selection box to view options.
3. Place the cursor in the selection box, scroll down to the setting you want to change, and **click** once on the setting.
4. **Left-click** again on the open screen to complete the selection.
5. **Right-click** on the open screen and select **Save to Reader** to implement the command in the imager.

Saving Options

- **Send, No Save**. Changes will be lost when power is re-applied to the imager.
- **Send and Save**. This activates all changes in current memory *and* saves to the imager for power-on.

2 Using ESP

Contents

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Menu Toolbar....2-4
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This section explains the basic structure and elements of **ESP** (Easy Setup Program).

When **ESP** is opened, unless otherwise specified in **ESP Preferences**, the **EZ Mode** view will appear. **App Mode** contains several tree controls (**Communication**, **Read Cycle**, **Symbologies**, **I/O Parameters**, **Symbol Quality**, **Matchcode**, and **Diagnostics**), a **Setup** interface, a **Terminal** interface, and a **Utilities** interface.

ESP can be used to configure the QX Hawk in three different ways:

- **Graphic User Interfaces:** Imager settings can be configured using such point-and-click tools as buttons, spin boxes, check boxes, and drag-and-drop functions.
- **Tree Controls:** Each tree control contains a list of all command settings that pertain to that specific area of imager operation. Each parameter can be configured using dropdown menus or fields where characters can be entered.
- **Terminal: ESP**'s **Terminal** allows the user to send serial configuration and utility commands directly to the imager by typing them in the provided field.

Information about using specific commands in **ESP** is provided in subsequent sections.

For **ESP** system requirements, see **Minimum System Requirements** in Chapter 1, **Quick Start**.

EZ Mode

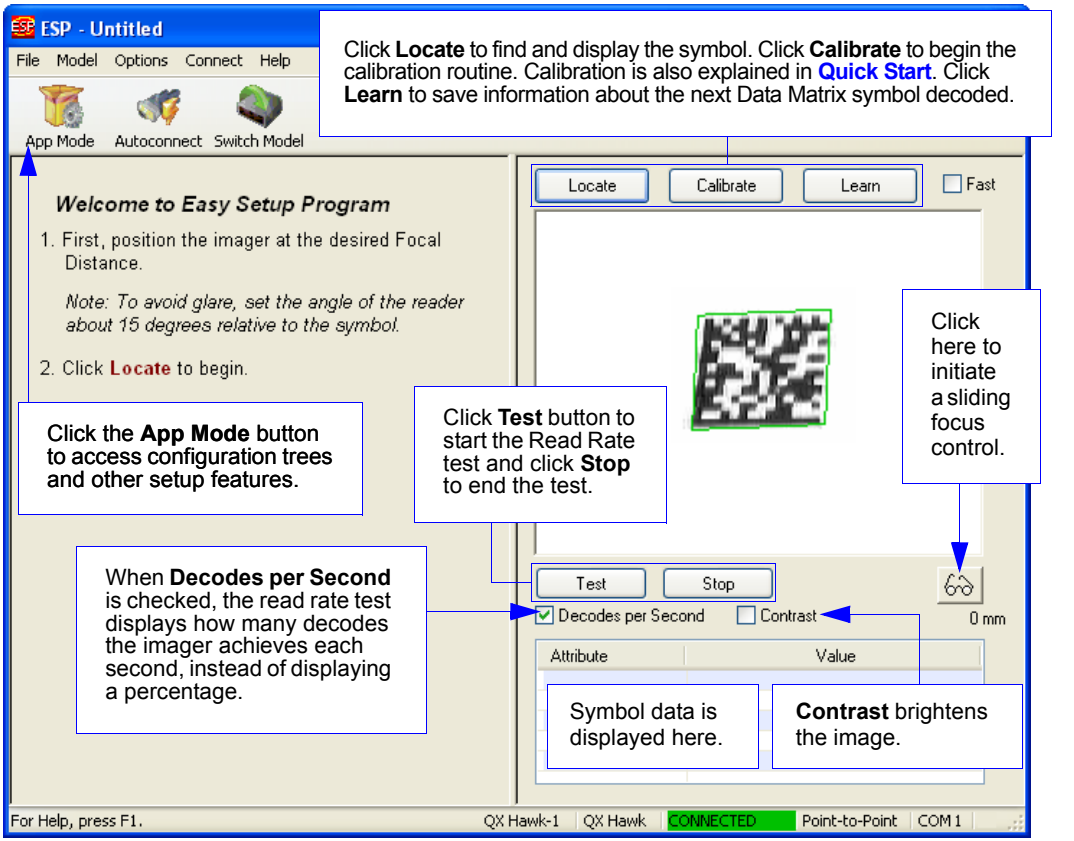
EZ Mode allows the user to test read rate and calibrate the imager. After connecting to the imager, the **EZ Mode** view will appear. On-screen instructions assist the user with positioning, testing, and calibration.

Locate/Calibrate/Learn

The calibration routine optimizes the imager by comparing Read Rates at various camera and image processing settings. Click **Locate** to find the symbol in the field of view and display it in the video view. Then click **Calibrate** to begin the calibration routine. The **Learn** button allows you to save information about the next Data Matrix symbol decoded, which allows faster and more consistent processing.

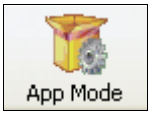
Test

Click the **Test** button to start the Read Rate test for a quick indication of the imager's read capabilities and the limits of the application. When **Decodes per Second** is unchecked, the test will count the percentage of decodes relative to the number of actual scans. Click **Stop** to end the test.

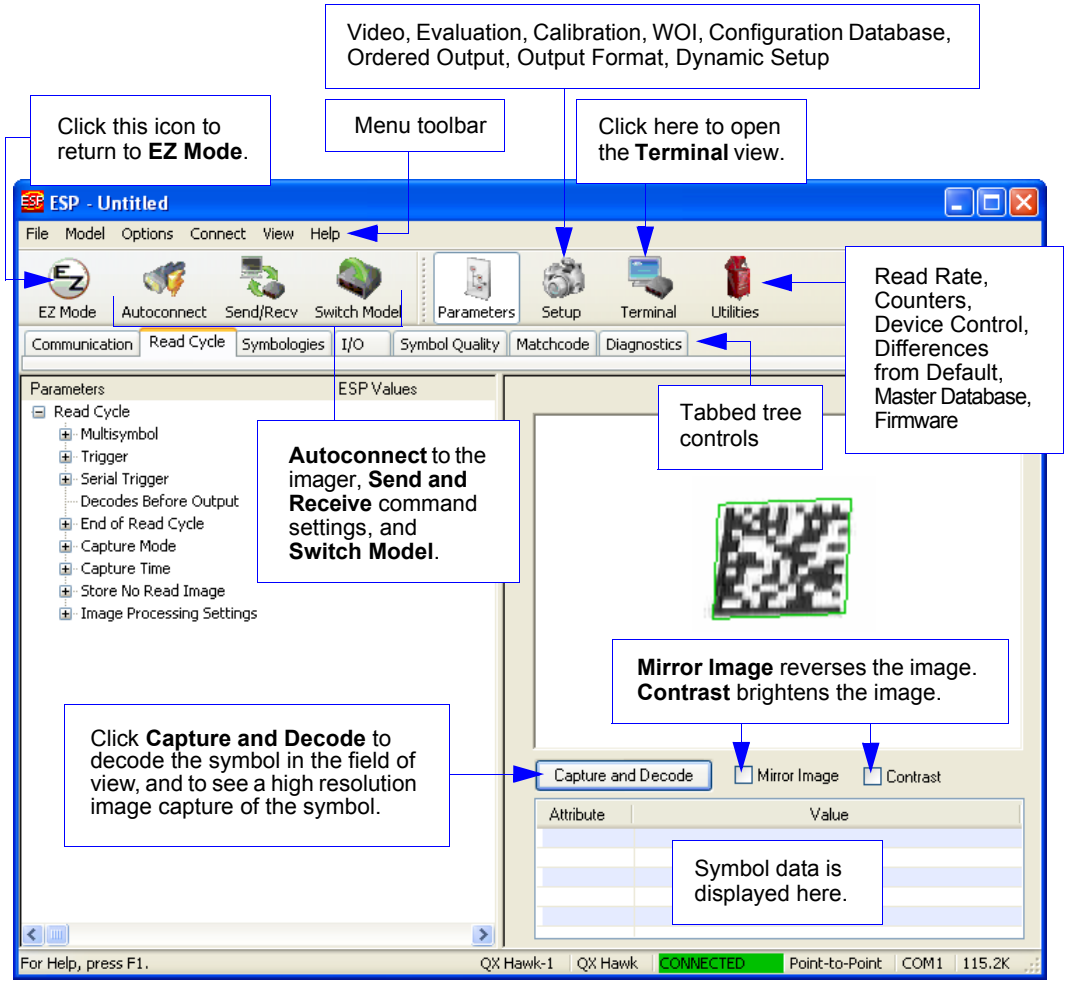


App Mode

From **EZ Mode**, click on the **App Mode** button to access the tabbed tree controls in **Parameters**, the intuitive user interfaces in **Setup**, the **Terminal** interface, and the **Utilities** interface.



Note: The **App Mode** and **EZ Mode** buttons appear in the same position to allow easy switching between these primary modes.



Menu Toolbar

File

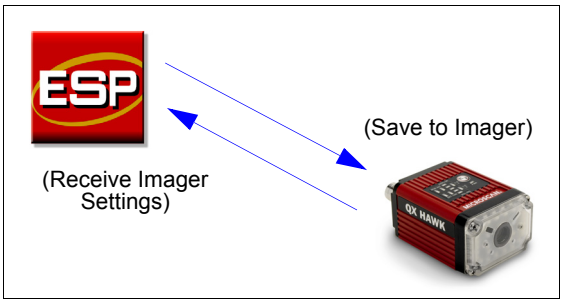
New

Whenever **New** is selected, the default configuration of **ESP** is loaded.

Open/Save

When **Save** or **Save As** is selected, the **ESP** configuration is saved to the host computer's hard drive and available whenever the same file is selected under **Open**.

Important: When configuration changes are saved to the hard drive, these changes are not automatically saved to the imager. The illustration below shows how settings can be saved and received between **ESP** and the imager, and **ESP** and the host hard drive.



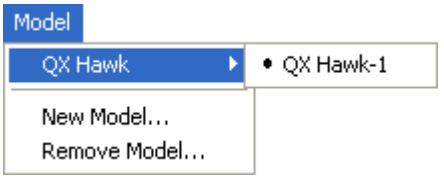
Import/Export

Import converts the ASCII settings from a text file to **ESP** configuration settings.

Export converts the active **ESP** configuration settings to an ASCII text file.

Model

The **Model** dropdown menu shows a list of recent imagers that have been used with ESP. When a different model is chosen, the connection to the present model is terminated.



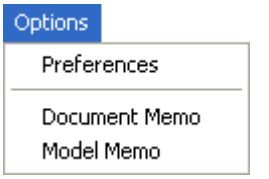
To connect to another model, select **New Model**, choose a new model from the **pop-up menu** that appears, and click **OK**.

Note: When an **ESP** file is saved, the settings of all the models defined in that file are saved.

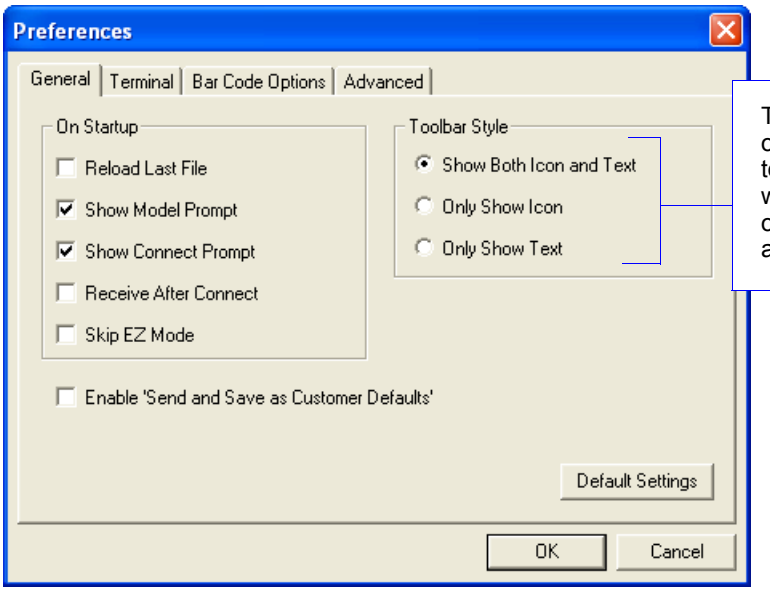
Options

The **Options** menu allows the user to save memos and set up **ESP Preferences**.

Note: Preferences will be saved and loaded into **ESP** whenever **ESP** is opened next, whether or not the **ESP** file is saved.



Preferences > General Tab



The **Toolbar Style** options allow the user to determine how **ESP** will display the mode options in the two rows at the top of the screen.

Reload Last File

At startup, reloads the last file saved to the host computer's hard drive.

Show Model Prompt

At startup, shows the model menu displaying all supported readers.

Show Connect Prompt

At startup, displays the **Would you like to connect to the QX Hawk?** prompt.

Receive After Connect

At startup, loads the imager's settings into **ESP**. (This is not recommended if **ESP** settings are needed for future use.)

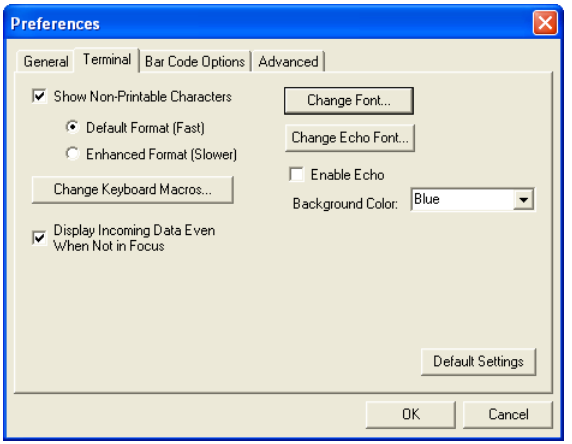
Skip EZ Mode

At startup, skips **EZ Mode** and opens directly in **App Mode**.

Enable 'Send and Save as Customer Defaults'

At startup, enables the **Send and Save as Customer Defaults** option in the **Send/Recv** command.

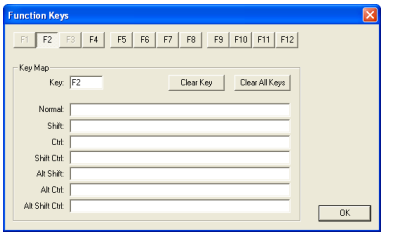
Preferences > Terminal Tab



Show Non-Printable Characters

When **Show Non-Printable Characters** is enabled, characters such as “CRLF” will be displayed in the Terminal window. When **Enhanced Format** is checked, the characters are displayed with more detailed formatting.

Change Keyboard Macros



Clicking the **Change Keyboard Macros** button brings up the **Function Keys** dialog. In this dialog, select the desired function key and then enter the macro keystrokes in the associated key map. For example, to make **Ctrl-F2** the keystroke to send a trigger character, select **F2**, then in the **Ctrl** row, enter **<trigger character>** and click **OK**. Then whenever the **Ctrl-F2** keystroke is pressed, the trigger character will start the read cycle.

Note: The **F1** key is reserved for opening **ESP** Help and the **F3** key is reserved for the **Find Next** function.

Change Font

Allows the user to modify the font used for decode data received from the imager on the Terminal.

Change Echo Font

Allows the user to modify the font used for command characters typed into the Terminal.

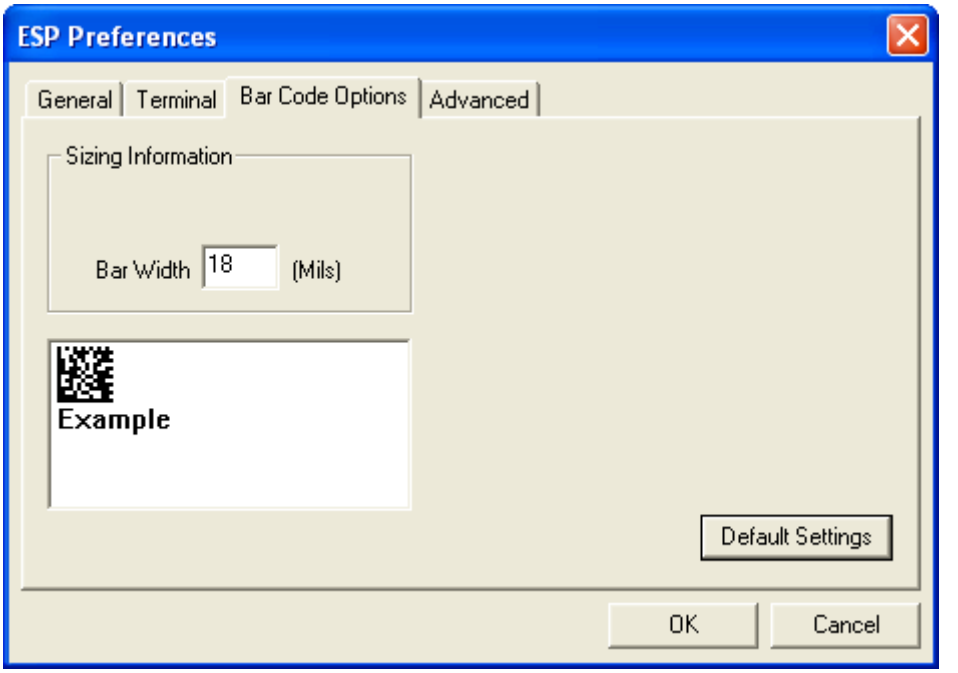
Enable Echo

Allows the user to enter command characters in Terminal.

Display Incoming Data Even When Not in Focus

When **Display Incoming Data Even When Not in Focus** is enabled, data from the imager will continue to appear in the Terminal even when **ESP** is not the top window.

Preferences > Bar Code Options Tab

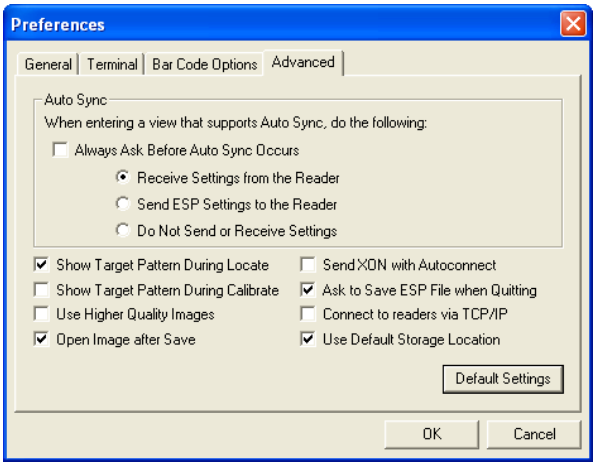


Sizing Information

Sets the bar height (in inches) and bar width (in **mils**, or thousandths of an inch) of user-created symbols.

Example: A bar width of 18 mils is 0.018 inches.

Preferences > Advanced Tab



The **Auto Sync** options at the top of the **Advanced** tab allow the user to determine whether Auto Sync will be enabled automatically in sections of **ESP** where it is used, or if it will ask before it enables Auto Sync functions.

Always Ask Before Auto Sync Occurs

If this option box is checked, specific Auto Sync functions can be enabled. **Receive Settings from the Reader** will automatically send the imager's settings to **ESP** when Auto Sync is enabled. **Send ESP Settings to the Reader** will automatically send all imager configuration settings chosen in **ESP** to the imager. **Do Not Send or Receive Settings** creates a condition in which Auto Sync will not automatically send imager settings to **ESP**, or send **ESP** settings to the imager.

Show Target Pattern During Locate

Allows you to determine whether the blue LED target pattern will be on or off during the **Locate** routine.

Show Target Pattern During Calibrate

Allows you to determine whether the blue LED target pattern will be on or off during the **Calibrate** routine.

Use Higher Quality Images

Sets **ESP** to output images at a higher resolution than standard JPEG format.

Open Image after Save

When **Open Image after Save** is enabled, **ESP** automatically opens saved image captures. Images can be saved from the **Evaluation** tab in the **Camera** view, or by right clicking an image in any other image capture view and then saving.

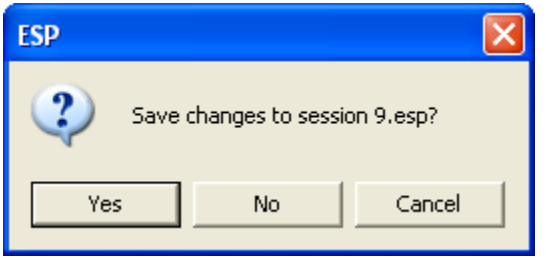
Send XON with Autoconnect

Sends an **XON** (**Begin Transmission**) command to the imager before starting the **Autoconnect** routine.

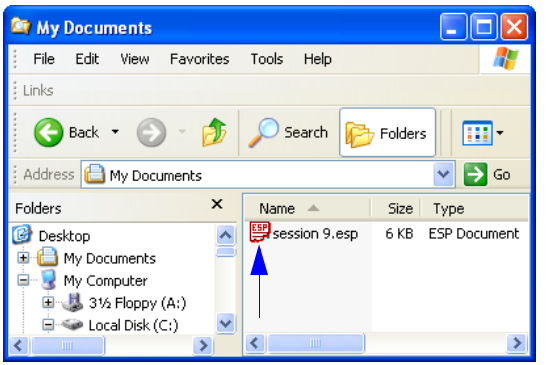
Preferences > Advanced Tab (cont.)

Ask to Save ESP File when Quitting

When enabled, prompts the user to save a **.esp** file when ending a session.

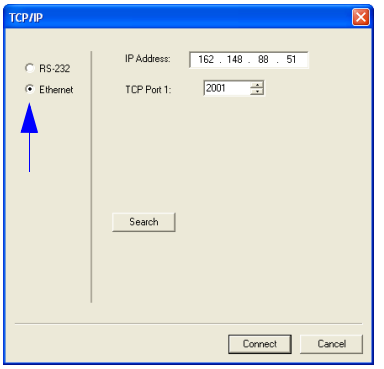


The **.esp** file will be saved in the location specified by the user.



Connect to Readers via TCP/IP

When enabled, shows the **TCP/IP Connection Wizard** by default.

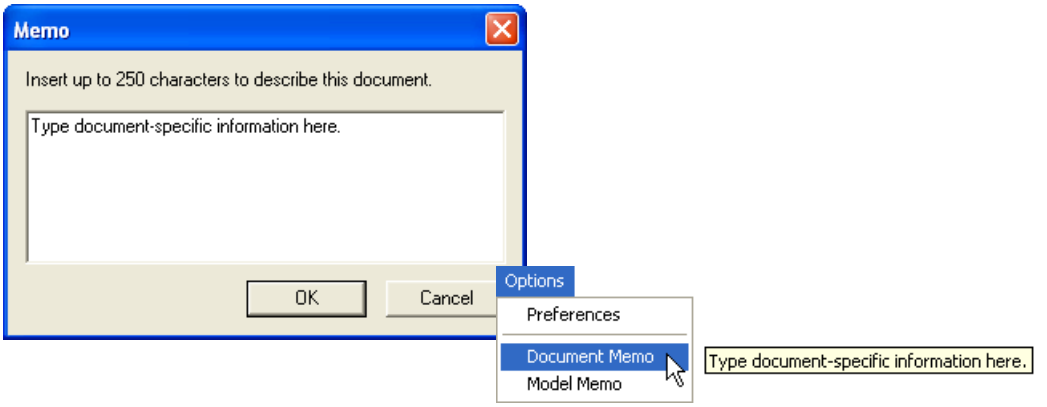


Use Default Storage Location

When enabled, automatically stores data in **ESP**'s Application Data folder.

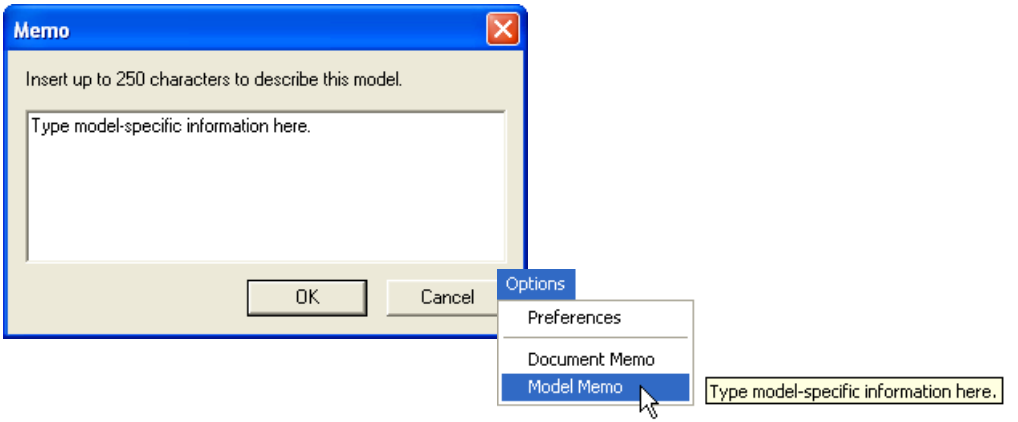
Document Memo

The information entered in the **Document Memo** field will appear in a context-sensitive text box whenever the cursor hovers over the **Document Memo** item on the **Options** menu.



Model Memo

Similar to **Document Memo**, the information entered in the **Model Memo** field will appear in a context-sensitive text box whenever the cursor hovers over the **Model Memo** item on the **Options** menu. Memos created in **Model Memo** are specific to the model enabled when the message was created.



Note: Memos must be saved in a **.esp** file to make them available in the next session. If the current session is not saved, any memos that have been entered during the session will be discarded, and will be unavailable in the next session.

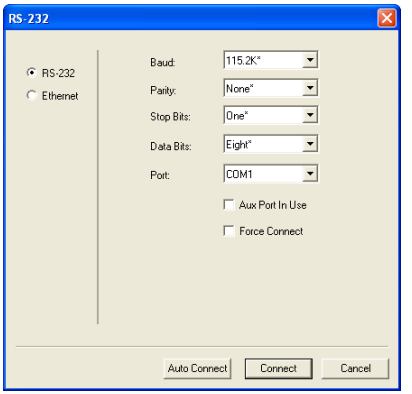
Connect

The **Connect** dropdown menu allows the user to access the **Connection Wizard**, as well as the **Autoconnect** and **Configure Multidrop** dialogs. **Connect** and **Disconnect** can also be performed directly from the dropdown menu without opening a dialog.

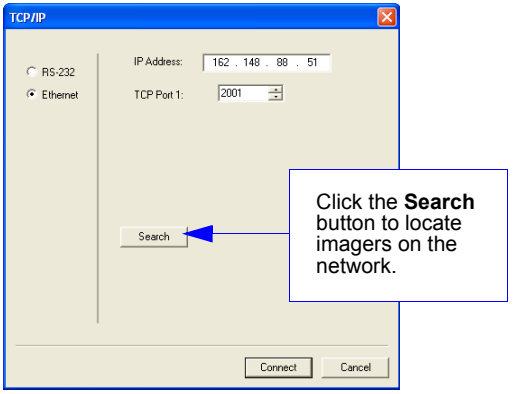
Connection Wizard

To connect using the Connection Wizard:

- Click **Connect** on **ESP**'s menu toolbar, and then select **Connection Wizard**.
- Select **RS-232** or **Ethernet** to activate the appropriate display.
- Configure RS-232 or Ethernet settings as required by the application, and click **Connect**.



RS-232 Connection Wizard

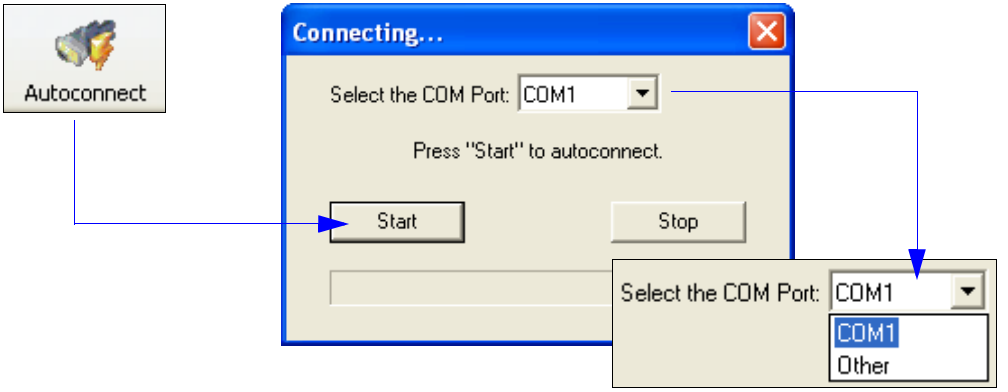


Ethernet Connection Wizard

- When a connection is established, the green indicator in the status bar at the bottom right of the screen will be visible:

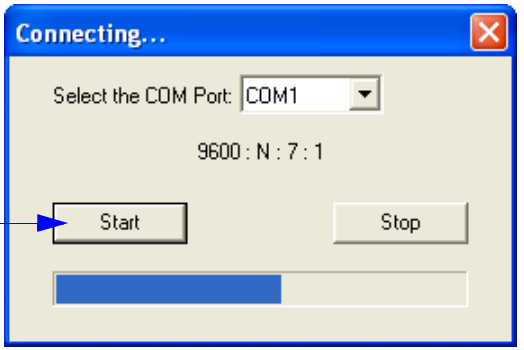
Autoconnect

- If the RS-232 connection attempt fails, use **Autoconnect** to establish a connection between the imager and the host.



- If the communication port is not the default **COM1**, use the dropdown menu to change the port.

- Once the correct port is chosen, click **Start** to connect.



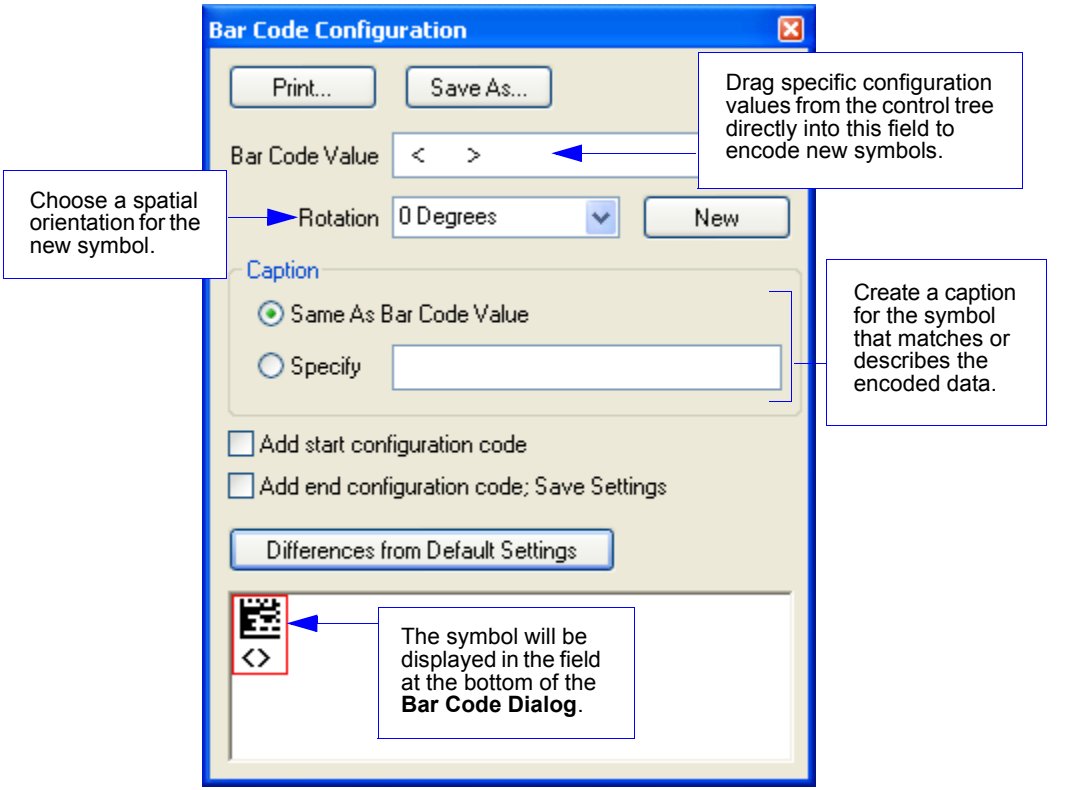
- When a connection is established, the green indicator in the status bar at the bottom right of the screen will be visible.

View

The **View** menu allows the user to move quickly between the **Parameters**, **Setup**, **Terminal**, and **Utilities** interfaces without using the icon buttons on the **App Mode** toolbar. It also allows the user to access the **Bar Code Dialog**, shown below.

Bar Code Dialog

Symbols can be created in the **Bar Code Dialog** by typing the text to be encoded. This is a useful tool for creating configuration symbols, allowing the user to configure the imager by reading the user-created symbols.

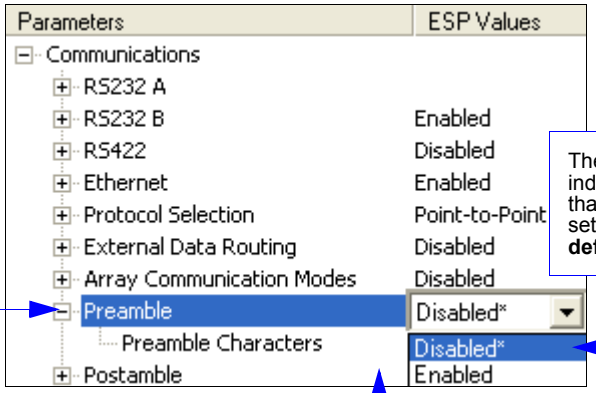


Navigating in ESP

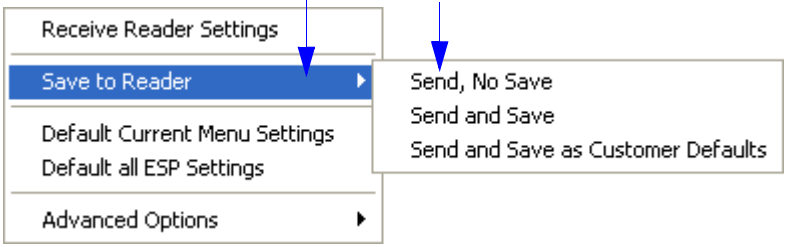
To change imager settings, or to access the **Setup**, **Terminal**, or **Utilities** views, click the **App Mode** button.

To return to **EZ Mode**, click the **EZ Mode** button.

To make changes to configuration settings in the tree controls:



1. **Left-click** on the **+** to expand menu items.
2. **Double-click** the desired parameter and **single-click** in the selection box to view options.
3. Place the cursor in the selection box, scroll down to the desired setting, and **single-click** the setting.
4. **Left-click** again on the open screen to complete the selection.
5. **Right-click** on the open screen and select **Save to Reader** to implement the command in the imager. The command can be sent without saving, or sent and saved simultaneously.



Send/Receive Options

To access **Receive**, **Save**, and **Default** options, click the **Send/Recv** button. These options can also be reached by right-clicking in any of the configuration views.

Receiving

From the **Send/Recv** menu, select **Receive Reader Settings**.

Caution: Selecting this option will upload the imager's settings. If the **ESP** file has a number of custom settings that must be maintained and downloaded into the imager, these settings will be lost.

This function is useful for receiving (uploading) the imager's settings and saving them as a file for future use. For example, if the imager has settings that must not change, **Receive Reader Settings** would load those settings to **ESP** and save them in an **ESP** file for later retrieval.

Receiving the imager's settings will also assure that any unwanted subsequent changes in ESP will not be saved.

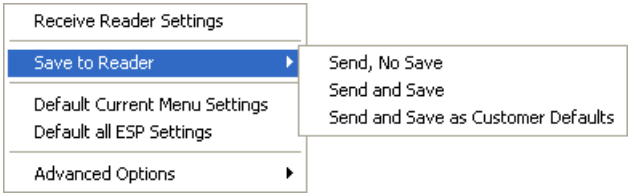
Saving

Send, No Save (<A>)

Saves **ESP** settings to current memory.

Send and Save (<Z>)

Activates all changes in current memory *and* saves to the imager for power-on.



Send and Save as Customer Defaults (<Zc>)

Saves default settings for quick retrieval.

This option will be visible only if **Enable 'Send and Save as Customer Defaults'** is checked in **ESP Preferences**.

Defaulting

When **Default Current Menu Settings** or **Default all ESP Settings** are selected, only the **ESP** settings are defaulted.

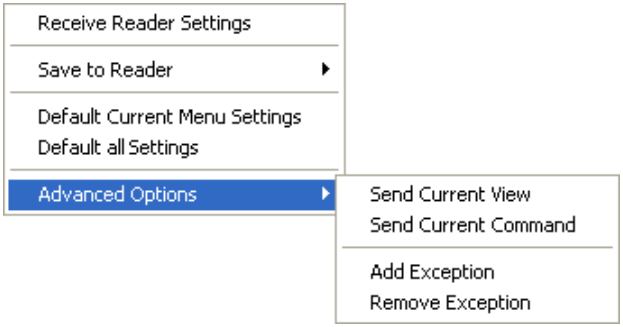
Advanced Options

Send Current View

This is the same as **Save to Reader** > **Send No Save** except that only the commands in the current configuration tree are sent.

Send Current Command

This is the same as **Send Current View**, except that it saves only the command that is currently selected.



Add/Remove Exception

After a **Receive Reader Settings** command is performed[1] and the **Add Exception** option is selected, a list of serial commands may appear. These are commands that may be in the imager's firmware, but are not included in, or are different from, the current version of **ESP**.

These commands can be edited by double-clicking them and changing them as needed.

It is important to note that these commands will be saved to the imager whenever a **Save to Reader** command is sent, or when an **<A>** or a **<Z>** command is sent.

Also, if there is a corresponding **ESP** menu item, the **ESP Value** column for that item will be blank following a **Receive Reader Settings** command.

1. From the **Send/Recv** button or by right-clicking in any blank section of a tree control view.

3 Hardware Integration

Contents

Connectors 3-2
Cordsets 3-3
QX Hawk and QX-1 Connectors and Pinouts 3-4
Power and Trigger Switching 3-8
Port Routing 3-9
Application Examples 3-10

This section introduces the details of QX Hawk hardware, and explains how that hardware can be integrated in an application.

Connectors

Industrial cabling and connectivity schemes must be able to withstand environmental extremes of heat, cold, and moisture, and be secure enough not to be disconnected or damaged inadvertently in the course of day-to-day operation.

The current industry standard for connectivity is a sealed, circular connector such as the M12. The International Electrotechnical Commission (IEC) **standard for M12 connectors** describes them as fixed and free screw-locking connectors. This type of connector is widely available off-the-shelf from manufacturers such as **Turck**, **Lumberg**, **Phoenix Contact**, **Molex**, or **Binder**.

The QX Hawk uses sealed, circular connectors with Ultra-Lock™ technology. Ultra-Lock connectors are more resistant to harsh industrial conditions, and are easy to connect.

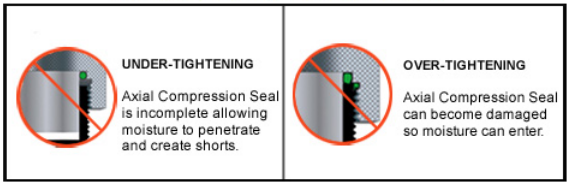
Ultra-Lock Connectors

Microscan has adopted Ultra-Lock connectivity because of speed, ease-of-use, and ingress protection considerations. The main advantage of the Ultra-Lock system is that only two steps are required at every connection point:

1. Align the connector and receptacle keys;
2. Push the connector into place. (Do not twist the connector, as this can bend the pins.)

Ultra-Lock connectors are “operator-independent”. This means that they are not subject to under-tightening or over-tightening, both of which are common problems with screw-down connectors, and both of which undermine the moisture-resistant seal.

Ultra-Lock Connector



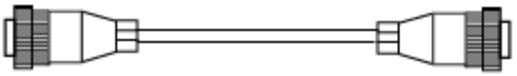
Traditional Threaded Connectors

Another advantage of the QX Hawk’s Ultra-Lock connectivity scheme is that the Ultra-Lock receptacles on the imagers and the QX-1 Interface Device also accept screw-down connectors, giving users the flexibility to use either Ultra-Lock or screw-down connectors.

“Ultra-Lock” is a trademark of Woodhead (Molex).

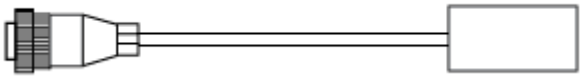
Cordsets

The terms “cordset” and “cable” are both applicable to industrial connectivity, but they are not synonymous. Cordsets enable communications and power between imagers and interface devices. Cordsets have an M12 Ultra-Lock connector at one or both ends. Examples of cordsets are shown below.



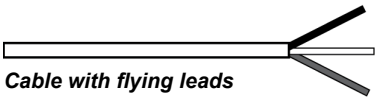
M12 Ultra-Lock to M12 Ultra-Lock Cordset

M12 Ultra-Lock to RJ45 (Ethernet) Cordset



M12 Ultra-Lock to Photo Sensor Cordset

Cables do not have M12 Ultra-Lock connectors at either end. An example of a cable is shown below.



Cable with flying leads

QX Hawk and QX-1 Connectors and Pinouts

When deploying a network of imagers and interface devices in an industrial setting, it is important to use components whose pin assignments are arranged in a way that avoids communication errors and equipment damage. This can be achieved with components that are designed in a logical, consistent, and easy-to-implement way.

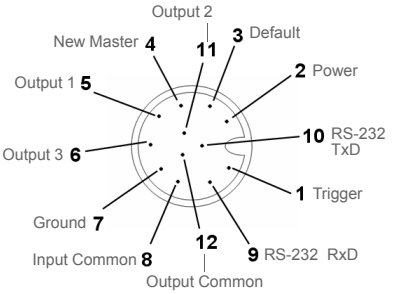
The QX Hawk has a very simple pin assignment methodology. The clearly identified connectors at the back of the unit can be used to receive and bus power, and also to send and receive data and commands.

See Appendix C – **Ground and Shield Considerations** for information about grounding the imager correctly.

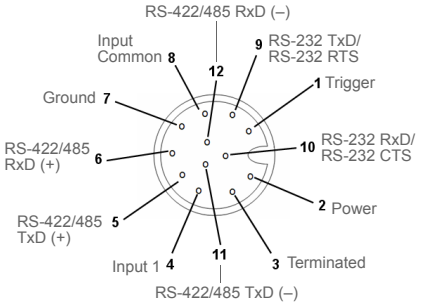
QX Hawk (Back View)

A is a serial M12 12-pin plug.

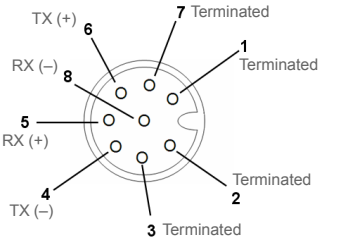
B is a serial M12 12-pin socket **or** an Ethernet M12 8-pin socket.



A (Serial) M12 12-pin Plug



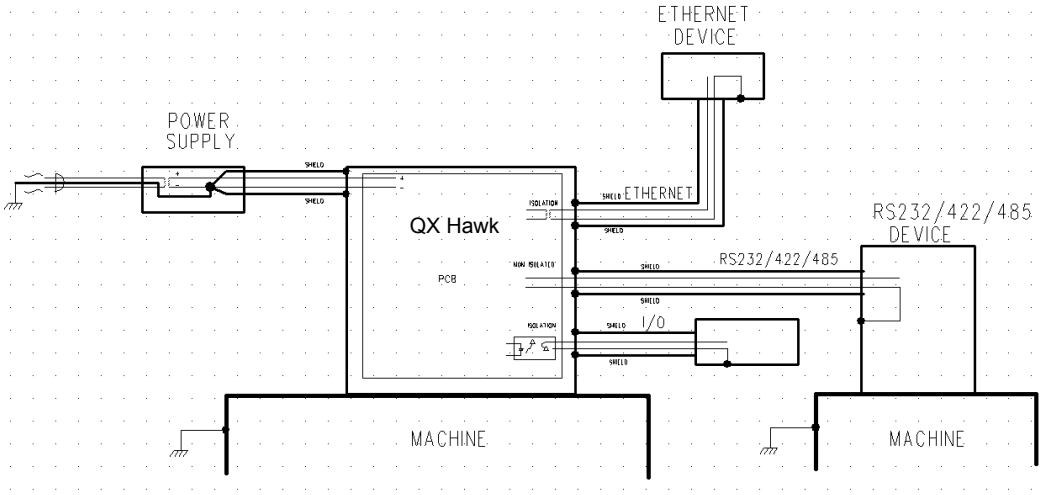
B (Serial) M12 12-pin Socket



B (Ethernet) M12 8-pin Socket

Grounding the QX Hawk

Proper grounding is necessary for operator safety, noise reduction, and the protection of equipment from voltage transients. Buildings, including any steelwork, all circuits, and all junction boxes must be grounded directly to an earth ground in compliance with local and national electrical codes.

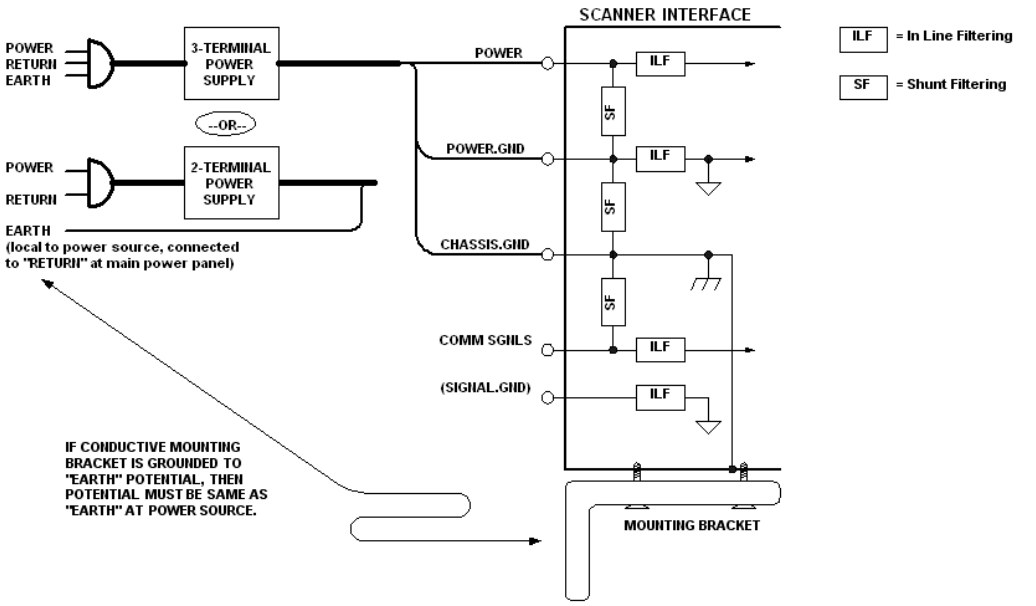


An earth ground is provided through the cable shields and chassis of the imager.

Ground Loops

Ground loops (signal degradation due to different ground potentials in communicating devices) can be eliminated or minimized by ensuring that both the host, imager, and their power supplies are connected to a common earth ground.

Expected Power and Ground Connections for Proper Operation

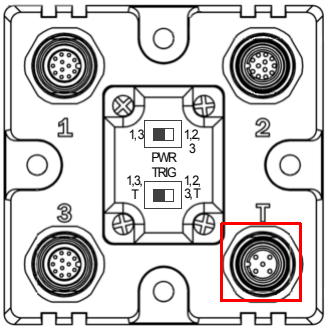


Grounding Notes:

- Ensure that mounting bracket “Earth” is at the same potential as power source “Earth”.
- Supply “Return” and “Earth” ground must be stable, low-impedance reference points.
- “2-Terminal Power Supply” must still provide an “Earth” connection to the imager.
- “Signal Ground” can be used for communications and/or discrete signal ground reference. It must **not** be used as Power Ground or Earth Ground.

QX-1 Interface Device

The QX-1 Interface Device's receptacles are physically the same as those on the QX Hawk, but they do not have explicit pin assignments. The QX-1 allows users to bus power and communications as required by the application.



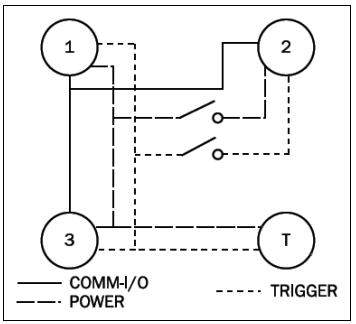
QX-1 Interface Device

Connectors 1 and **3** are 12-pin plugs, and **Connector 2** is a 12-pin socket. All three connectors can be assigned to bus power and data as required by the application.

The two switches at the center of the device allow the user to route signals as needed.

Pin	Assignment
1	+ 10-28V
2	Trig/NM/Input 1 Common
3	Ground
4	Trigger

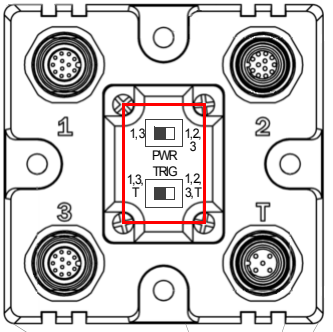
QX-1 Trigger Connector 4-pin Socket



QX-1 Communications - I/O - Power - Trigger

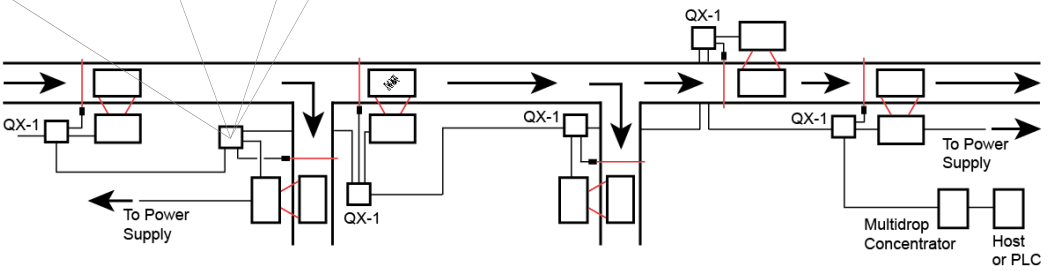
This simple diagram (shown on the base of the QX-1) illustrates how power, communications, I/O, and trigger signal can be routed through the QX-1 device depending on the needs of the application. The switches greatly increase signal routing flexibility.

Power and Trigger Switching



Power can be bussed between imagers and interface devices. At each location on a network where a new power supply is added, the Power switch on the QX-1 can be used to break power between Connector 2 and Connectors 1, 3, and T.

The **Trigger** signal between Connector 2 and Connectors 1, 3, and T can be broken using the Trigger switch. This isolates trigger signals as required by the application.



Port Routing

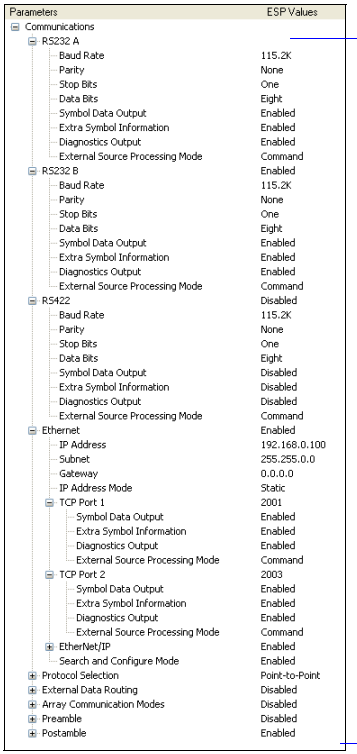
The physical advantages created by flexible signal routing and switching are enhanced further by **Port Routing**, which can be configured in **ESP**. Port Routing eliminates the need for dedicated “Host” and “Aux” ports in a traditional sense. With Port Routing, any port can be defined as a Host or Aux port. Port Routing also allows users to define the data types that are accessible from specific ports.

The primary benefit of Port Routing is that any type of data can be routed to any port, and can be sent through multiple ports simultaneously. Multiple types of data can also be appended to the symbol data that is output from the imager to the host. Command data, symbol data, extra symbol information, and diagnostic data are enabled by default in the QX Hawk.

The table below lists different types of data, with examples for each data type.

Data Type	Example
Command Data	Serial commands; imager responses to serial commands.
Symbol Data	Any string of data encoded in a symbol.
Extra Symbol Information	Decodes per trigger, decode direction, configuration database index number.
Diagnostic Data	Service message.

The screen capture below (from ESP) shows the QX Hawk’s four communications ports and the parameters for each.



RS-232 A, **RS-232 B**, and **RS-422** are serial. RS-232 A is always enabled. RS-232 B and RS-422 can be enabled or disabled to match the physical requirements of the application. **Ethernet** can also be enabled or disabled as required.

RS-232 A, RS-232 B, and RS-422 can be configured for Baud Rate, Parity, Stop Bits, Data Bits, Symbol Data Output, Extra Symbol Information (Decodes Before Output, Symbol Position Output, etc.), Diagnostics Output, and External Source Processing Mode (Command or Data).

Ethernet can be configured for IP Address, Subnet Mask, Gateway, IP Address Mode, Symbol Data Output, Extra Symbol Information, Diagnostics Output, and External Source Processing Mode.

Application Examples

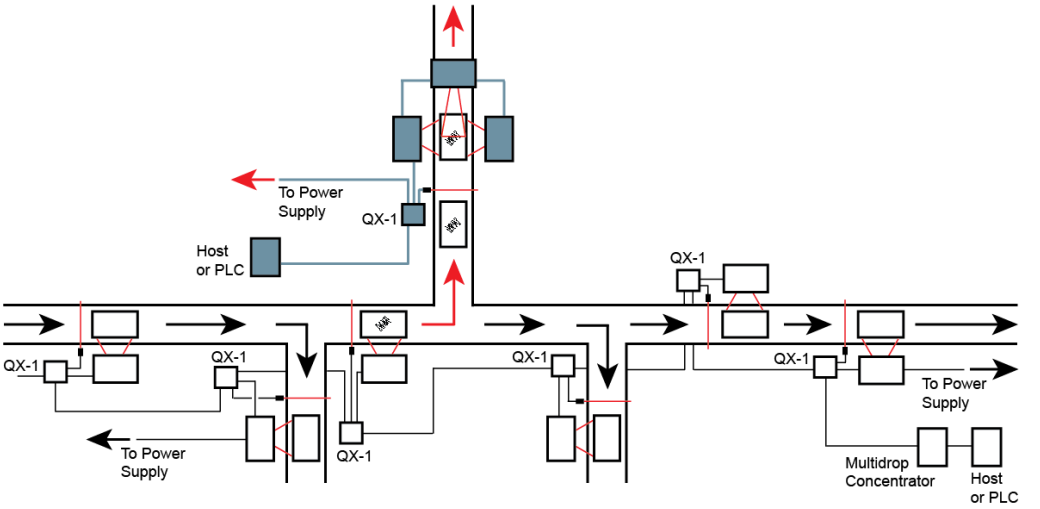
The following examples demonstrate how the components described in previous pages can be deployed in industrial applications.

Daisy Chain

Daisy chain configurations are used in applications such as product packaging, where single items have multiple symbols. For example, a box with one symbol on the top and symbols on either side requires at least three imagers to ensure that all symbols will be decoded.

The highlighted areas below demonstrate how a daisy chain can be arranged. One imager is placed above the conveyor line and one imager is placed on each side of the line. The three imagers essentially function as a single imager, and data is sent from the primary imager to the host or PLC.

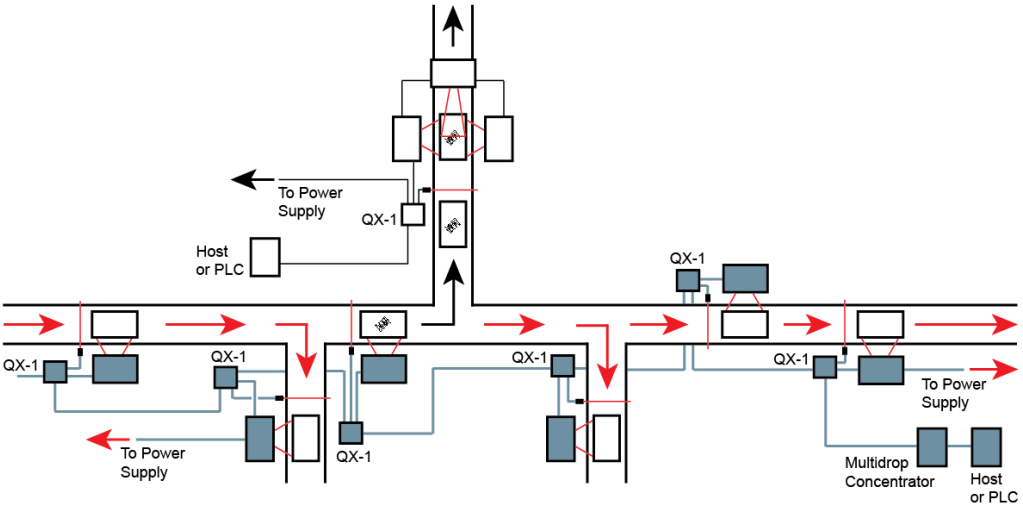
Important: Do not attempt to power more than four imagers with a single power supply in a daisy chain configuration. Add a QX-1 and one power supply for every four additional imagers in the daisy chain.



Multidrop

Multidrop networks are used in applications where it is necessary to decode symbols at multiple locations within an industrial process. Imagers are placed at stations located between manufacturing steps, and data from those imagers is directed to a multidrop concentrator before being sent to a host. An example of this type of application is food packaging, in which part number data is collected and tracked throughout the packaging process.

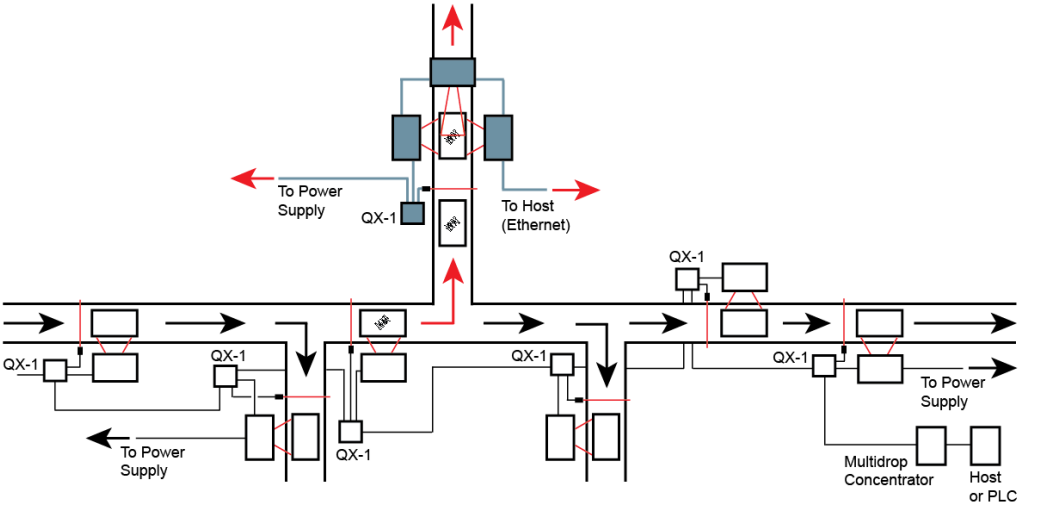
The highlighted areas below demonstrate how a multidrop network can be arranged.



Ethernet TCP/IP

Ethernet TCP/IP is the standard Ethernet interface used to connect multiple locations in a network, such as computers in an office network. It can also be used to network other communications devices, such as imagers and PLCs on a factory floor.

The highlighted areas below demonstrate how an Ethernet daisy chain can be arranged. Ethernet-enabled imagers can also be set up in standalone configurations, or multiple Ethernet-enabled imagers along a production or packaging line can be connected to Ethernet.



4 Setup

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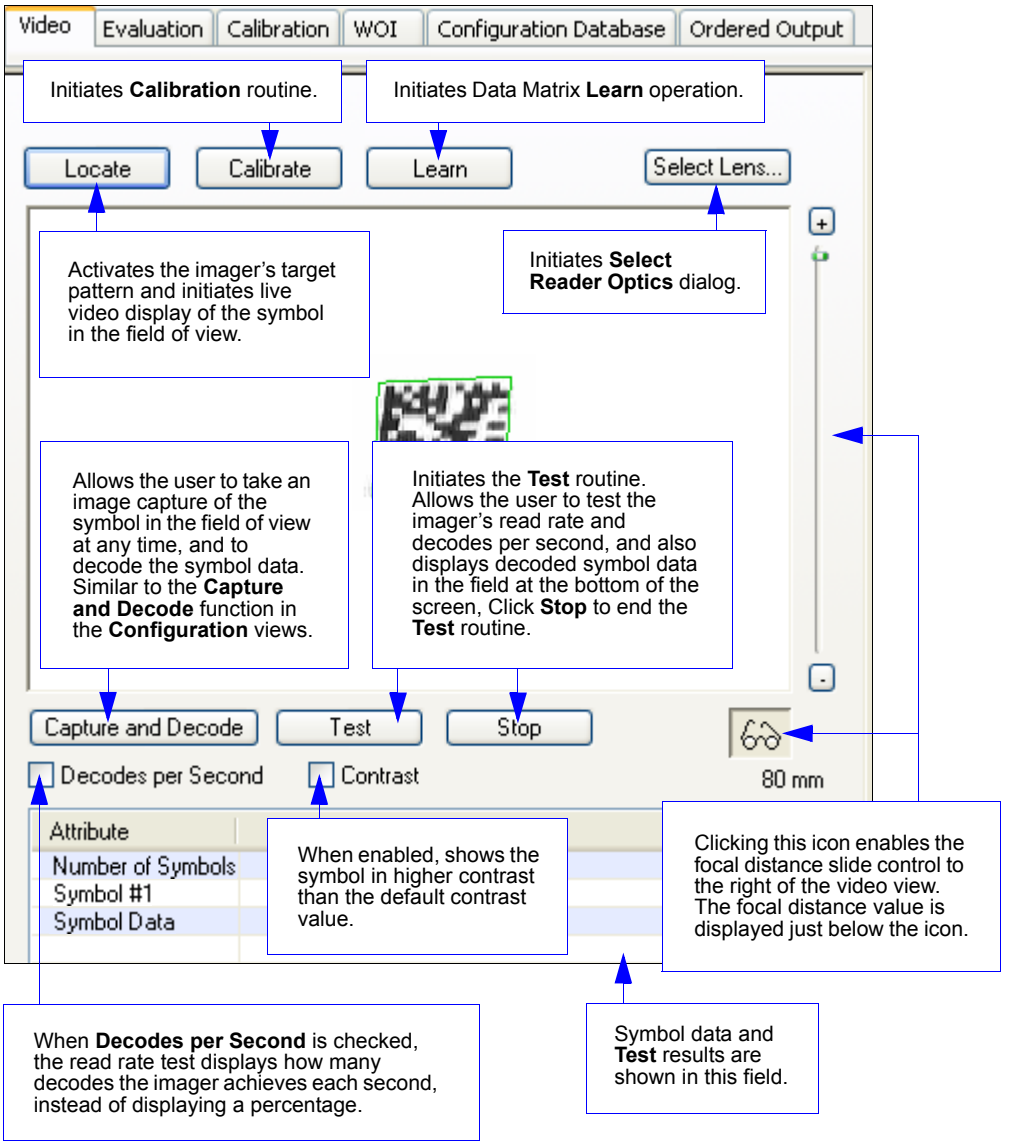
Dynamic Setup 4-32

This section describes ESP's **Setup** interfaces: **Video**, **Evaluation**, **Calibration**, **Window of Interest**, **Configuration Database**, **Ordered Output**, **Output Format**, and **Dynamic Setup**. Each interface allows the user to make changes to imager configuration quickly and easily.

Video

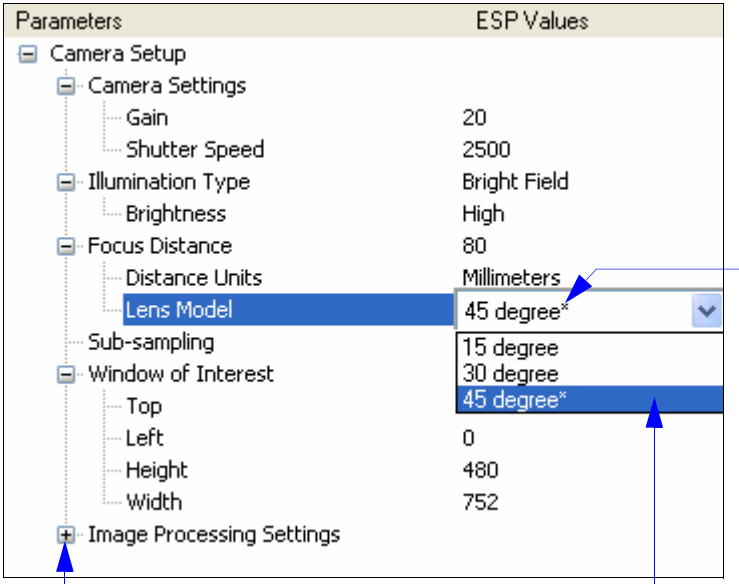
The **Video** view allows the user to perform the same **Locate**, **Calibrate**, and **Test** routines. There is also a focal distance adjustment tool to the right of the video view.

Video also features simple **Capture and Decode** functionality.



Camera Setup

Click the **App Mode** button and then the **Setup** button.
You will see the **Camera Setup** tree control to the right of the **Video** interface.



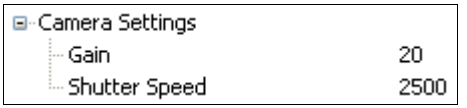
The * indicates that the setting is the default.

To open nested options, **single-click** the **+**.

To change a setting, **double-click** the setting and use the cursor to scroll through the options.

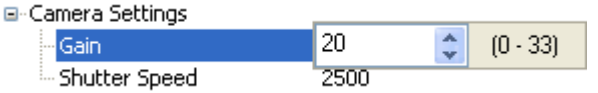
Note: Communication settings can also be sent to the imager from ESP's Terminal using Microscan's K command format.

Camera Settings



Gain

Sets the gain value for the image sensor. This setting can be configured through autocalibration, and is the recommended method for configuring this settings. A higher can value will increase the brightness of the image, but the noise performance of the system is reduced. Prior to configuring the gain, the required shutter speed should be set, and the gain should be configured to optimize the shutter speed setting.



Shutter Speed

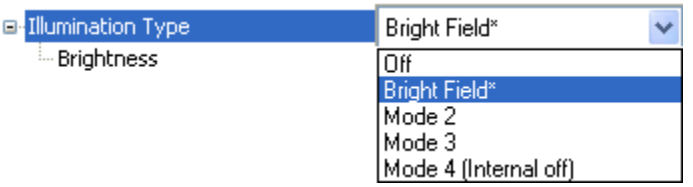
This value sets the exposure or integration time for the image sensor pixels. The shutter speed setting in relation to the speed of the object is critical. If an object is moving fast and a slow shutter speed is selected, blurring or smearing of the object will occur. As shutter speed is increased the amount of light required or gain needed has to be increased since the pixels exposure time has decreased.

Illumination Type

Mode

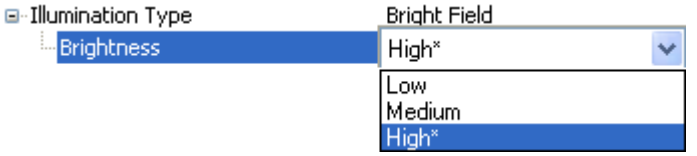
Configures the illumination pattern. “Bright Field” is used for most applications. The other modes are reserved for future feature enhancements.

For Mode4, the internal illumination is always off, similar to configuration setting 0 (Always Off).



Brightness

Configures the amount of illumination output from the unit’s built-in lighting.



Focus Distance

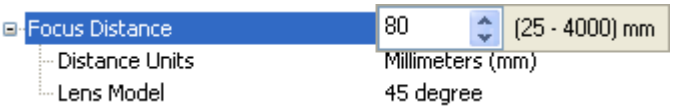
Provides focal distance adjustment for the camera.

When “Distance units” is set to “millimeters”, the Focal Distance parameter has a range of 25 to 4000. Any value outside this range will be rejected.

When “Distance units” is set to “1/100 inch”, Focal Distance is limited to a range of 100 to 4000. If the user attempts to set the Focal distance to less than 100 (1 inch), the parameter will be set to 100.

When a lens is changed on the QX Hawk, the user can improve the accuracy of the Focal Distance parameter by using the **<@OPTIC>** command.

Even after running **<@OPTIC>** the system distance accuracy is approximate. The command gives reasonable step sizes as apposed to completely unknown magnitudes but it is not expected that 2 units will exhibit the same exact focus for a given setting.



Distance Units

Defines the measurement unit value of the Focal Distance parameter.

Required Focal DistanceDistance Units = millimeter (0) Distance Units = 1/00 inch (1)

Lens Model

This value must reflect the correct camera lens currently installed on the product. This value is properly configured after leaving factory. However, since the lens can be changed by the user, this parameter needs to be updated to reflect the currently installed lens.

To verify lens type, turn off power to the QX Hawk (do not look into the targeting laser). Then look at the outer rim of the unit's camera lens. The following markings define the correct "Lens Type" parameter value:

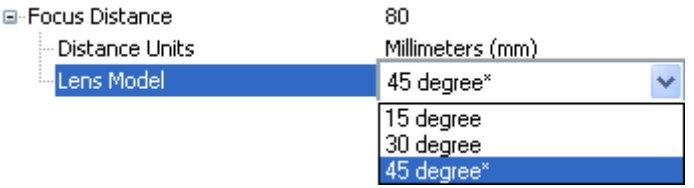
'.', and "15" = Lens Type 1

'..', and "30" = Lens Type 2

'...', and "45" = Lens Type 3

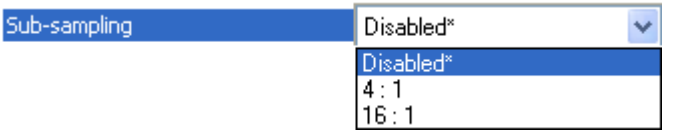
When a lens is changed on the QX Hawk, the user can optimize the accuracy of the Focal Distance parameter by using the **<@OPTIC>** command.

This parameter is "sticky". Once saved with a **<Z>** or **<Zc>** command, it can only be "defaulted" with **<Zrdall>** or **<K525d>**.



Sub-Sampling

The camera can be enabled to sub-sample pixels in the specified image frame. Sub-sampling can be specified as either 4:1 or 16:1, which signifies the sampling rate.



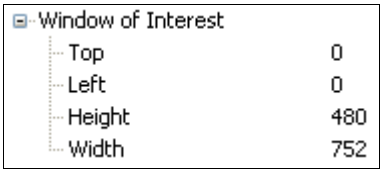
4:1

1 pixel output for every 4 pixels sampled. When selected the image will be sampled 2:1 in the vertical direction and 2:1 in the horizontal direction for a combined 4:1 ratio. An image with a dimension of 640 x 480 will be scaled to 320 x 240.

16:1

1 pixel output for every 16 pixels sampled. When selected the image will be sampled 4:1 in the vertical direction and 4:1 in the horizontal direction for a combined 16:1 ratio. An image with a dimension of 640 x 480 will be scaled to 160 x 120.

Window of Interest



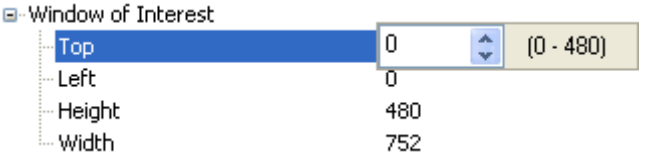
The active pixel area of the image sensor is defined as the “Window of Interest” (WOI). This allows the user to select an area in the Field of View that the desired symbol will be located. The programmable window of interest is useful for increasing decode speed, improving threshold, selecting desired symbol from multiple symbols in FOV. The user provides the upper-left pixel location and the size in both rows and columns to define the Window of Interest.

Important Notes:

- The column width value is required to be a modulus 16 value, so regardless of the column width setting that is configured the actual column width will be decreased (if required) to a modulus 16 value. For example a column width value of 632 would actually be 640. A user request of this setting would still return 632.
- The column pointer is required to be an even value, so regardless of the column pointer setting that is configured the actual column pointer will be decreased (if required) to an even value. For example a column pointer value of 101 would actually be 100. A user request of this setting would still return 101.

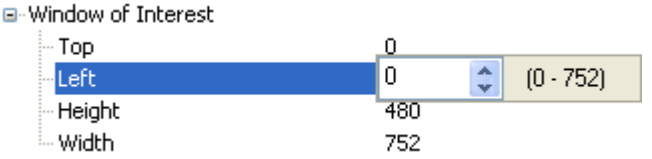
Top

Defines the row position of the upper-left starting point of the image window.



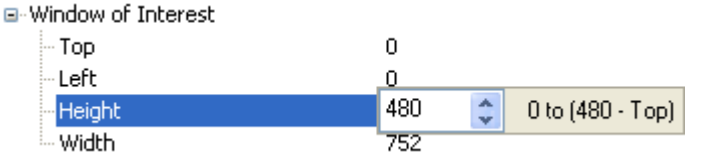
Left

Defines the column position of the upper-left starting point of the image window.



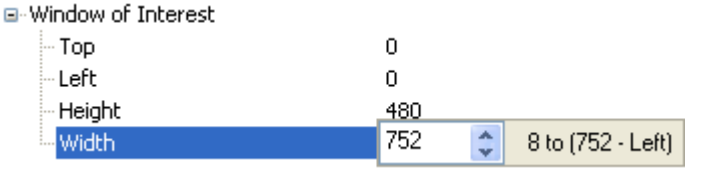
Height

Defines the size, in rows, of the image window. Maximum value is defined as the Maximum row size of Image sensor, minus the row pointer value.

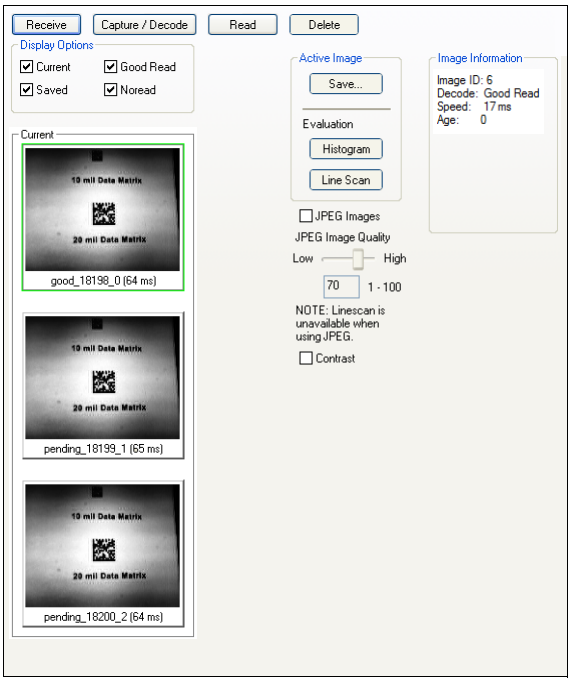


Width

Defines the size, in columns, of the image window. Maximum value is defined as the Maximum column size of Image sensor, minus the column pointer value.



Evaluation



In **Evaluation**, you can view images currently in the imager, capture and decode a symbol, save it as a digital file, and perform histogram and line scan evaluations.

When you click on the **Evaluation** tab, you will see the images that are currently stored in the imager.

Click **Receive** to refresh this view.

Click **Capture/Decode** to display the and decode event will occur, regardless of read cycle settings.

Click **Read** to trigger a read cycle. If there is enough time in the read cycle, up to 32 good reads (or 6 full-scale images) can be captured and displayed, depending on the size of the images, and depending on the number enabled in **Number of Captures** under **Capture Mode** in the **Camera Setup** menu tree to the left of the tabs.

If you click **Save**, the current image will be saved to the location of your choice.

Note: An image can only be saved in the format in which it was uploaded to **ESP**. JPEG images will be saved as **.jpg**, and bitmaps will be saved as **.bmp**.

When you click the **JPEG Image** box, notice that the **Line Scan** button is grayed out.

The JPEG option allows faster captures and transfers, but since the JPEG standard compresses image data, it is not suitable for the more rigorous demands of line scan evaluation.

JPEG also allows you to adjust the image quality (resolution) by adjusting the sliding tab between 1 and 100, 1 being the lowest quality and 100 being the highest.

When possible, use the highest quality; when image transfer speed must be increased, use a lower image quality setting. Adjustments for this setting will depend on your specific hardware and software limitations.

Histogram

The **Histogram** function is useful in determining quality and contrast of symbols. A histogram is a graphic representation of the numeric count of the occurrence of each intensity (gray level) in an image. The horizontal axis represents the values of gray levels, and the vertical axis represents the number of pixels for each gray level.

Note: Since histograms are performed in the imager, the results will be saved regardless of whether the image was uploaded as a JPEG (**.jpg**) or a bitmap (**.bmp**).

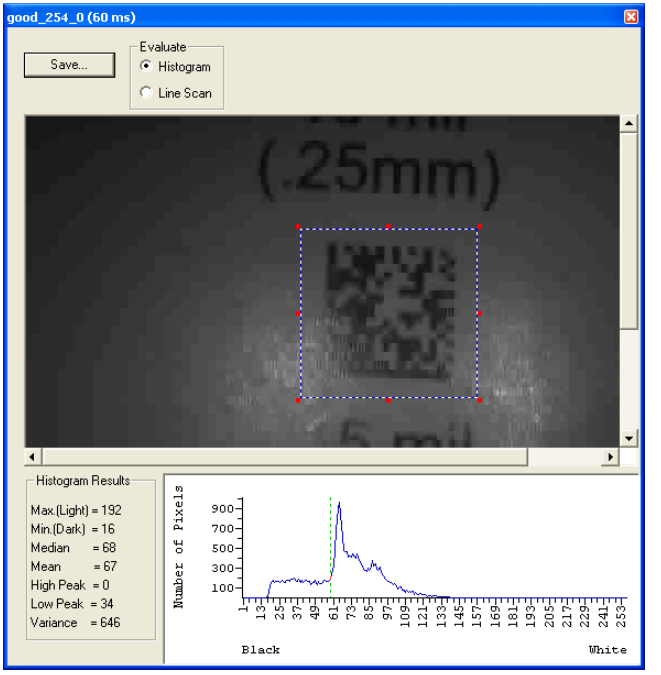
1. From the **Evaluation** window, click the **Histogram** button.

   The current image is transferred into the histogram operation. This may take a moment, since all the relevant pixels are being evaluated intensively.

2. When the **Histogram** window opens, you may need to expand the window and/or adjust the scroll bars in order to bring the image into view.

3. To generate a histogram, click and drag your cursor diagonally across the symbol or a portion of the symbol.

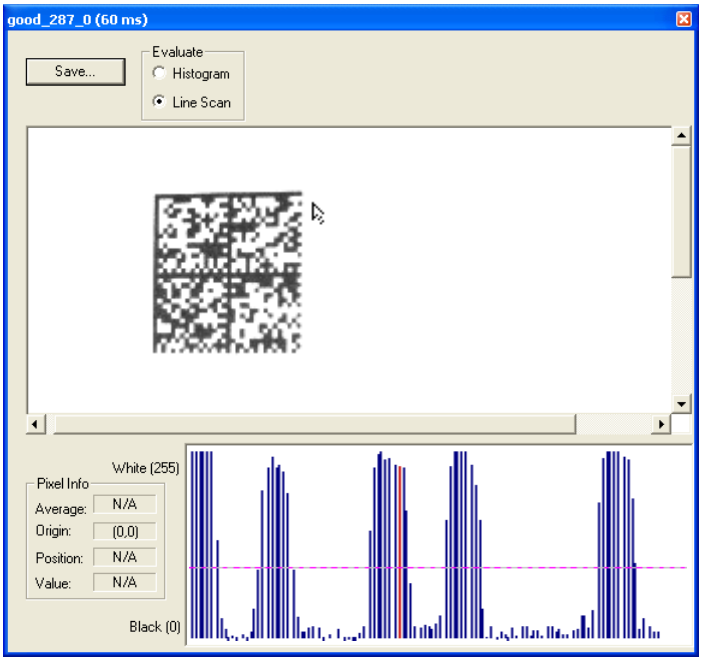
   The image will be surrounded by an “area of interest box”, a dashed blue line with red anchor points that can be selected and moved by placing a cursor inside the box, and can be resized by clicking and dragging the anchor points.



Line Scan

1. From the **Evaluation** tab, click the **Line Scan** button. A window like that shown below will appear.
2. Drag your cursor *horizontally* across the image.

   This will create a dashed horizontal line. Pixel information and a visual representation of the dark and light pixels will be displayed below the image.



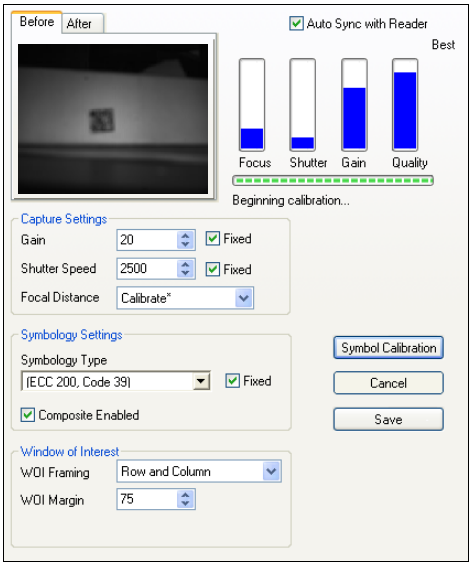
When you center your cursor over the dashed line, it becomes a double arrow cross. This allows you to move the line anywhere in the window. You can also use your keyboard arrows to move the line incrementally in any direction.

As with the histogram, the line scan compares light and dark pixels, but in a spatial distribution. On the **Y** axis of the graph below, **0** is black and **255** is white; the **X** axis represents the horizontal axis of the symbol as described by the line scan.

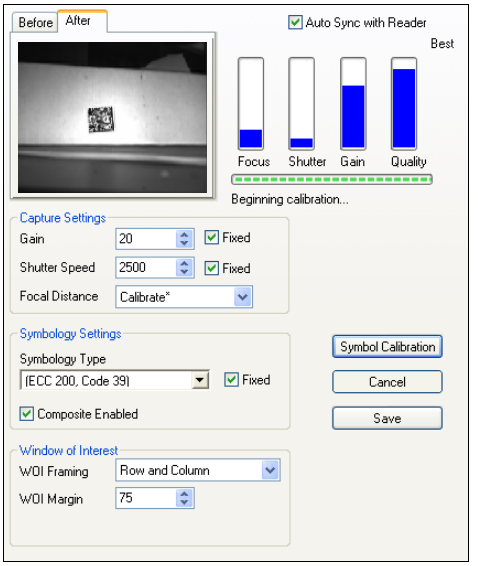
When you click anywhere on the graph, a vertical red line appears at that point and its position and value (in terms of black-to-white) are updated in the **Pixel Info** table to the left of the graph (237 in this example). In addition, a horizontal dashed red line is displayed that indicates the average value.

Calibration

The Calibration interface in **ESP** is a powerful and intuitive way to optimize the imager's performance. It allows the user to control several complex, simultaneous calibration operations, and to follow the progress of those operations using cues such as progress bars, real-time representations of calibration values, and other dynamic user feedback.



ESP's Calibration interface shown during a calibration routine

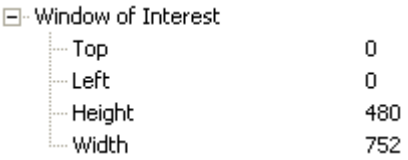


ESP's Calibration interface shown after a calibration routine

Window of Interest

The active pixel area of the image sensor is called the **Window of Interest** (WOI). The WOI allows the user to select an area of the field of view in which the desired symbol is located.

The programmable window of interest increases decode speed, improves threshold, and makes it easy to select specific symbols from among several in the field of view. The user provides the upper-left pixel location and the size of the window to define the Window of Interest.



Caution: Window of Interest will shrink the field of view and therefore could cause symbols to be missed in dynamic applications.

Window of Interest Graphic Interface

1. From the **Camera** menu, click the **WOI** tab to bring up **Window of Interest**.

   If you haven't already captured an image, click the **Capture and Decode** button to decode the present image. If successful, the **Good Read** indicator on the **WOI** tab will be green and the symbol will appear in the pane below.

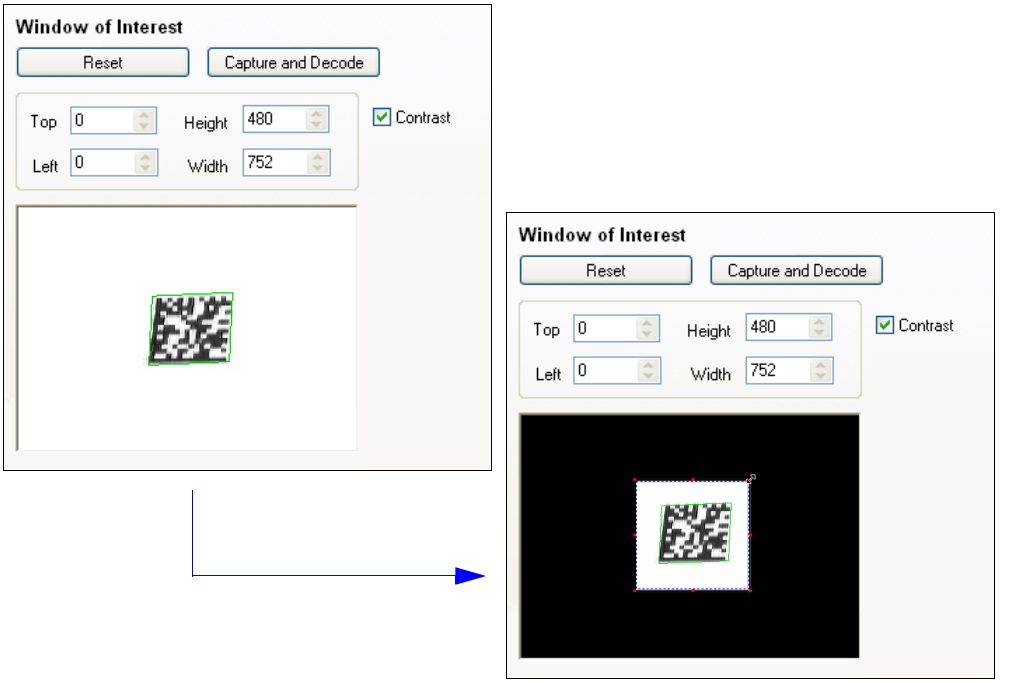
   Note: You can resize the image by clicking and dragging the **ESP** window from the lower right corner. This is useful where very small symbols are being read.

2. Click and drag your cursor over the symbol that you want to isolate for reading.

   Notice that the surrounding area goes black.

   You can use the handles on the image area that you have just drawn to resize the region of interest. You can also click on the center of the window of interest and move it.

3. Test the new settings in **Read Rate Mode**.



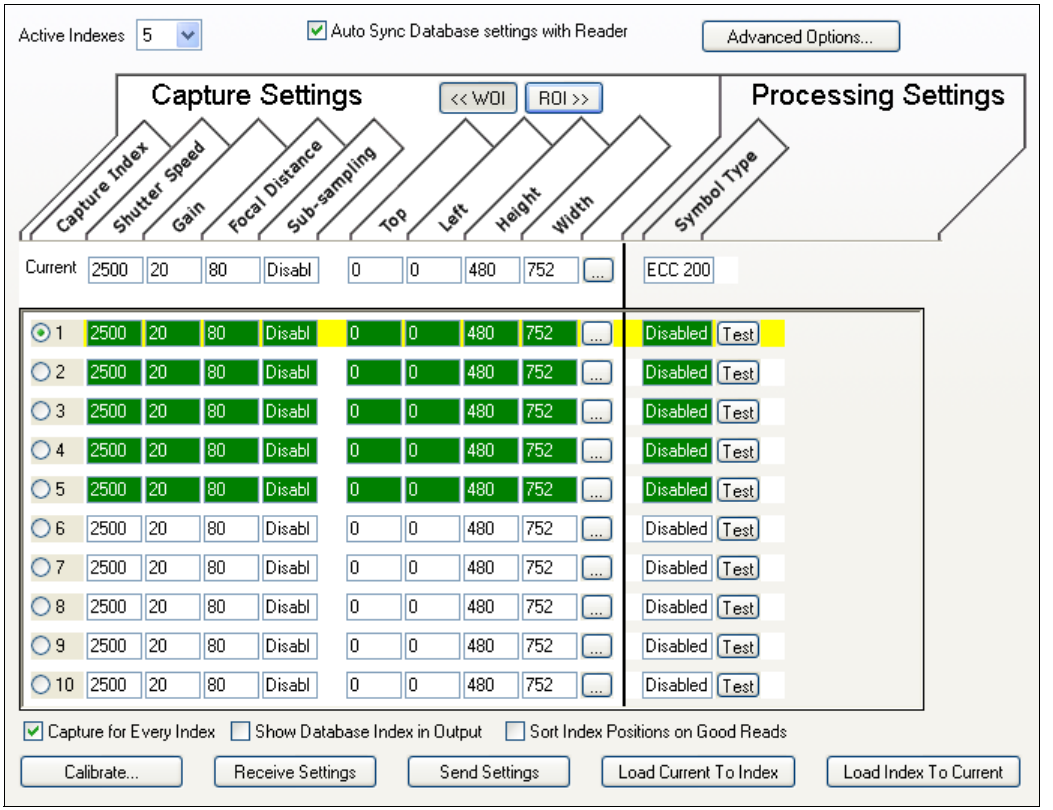
Note: To remove the window of interest, click the **Reset** button or click anywhere in the WOI pane.

Note that all pixels not in the WOI are defined as black.

Because the imager has far less processing to do in a smaller window, read rates typically increase dramatically. One possible downside is that the chance of missing a symbol increases with the smaller window. Always verify that your WOI will be large enough to allow for any random movement of symbols in your field of view.

Configuration Database

The Configuration Database allows the user to manage multiple configuration profiles. It is a useful tool in applications that require several different imager configurations to be applied sequentially, and it allows the user to perform far more complex operations than would be possible with only one set of configuration parameters.



Configuration Database view, set for 5 Active Indexes, with Capture Settings highlighted

As soon as the number of active database settings is something other than 0, the database is enabled. Once enabled, the current configuration settings (that are handled by the database) have no impact on imager operation.

Capture Index

Each index in the database can be configured and tested individually.

Shutter Speed

Sets the camera's shutter speed for the selected index.

Gain

Sets the camera's gain for the selected index.

Focal Distance

Sets the camera's focal distance for the selected index.

Sub-Sampling

Sets the sub-sampling rate (4:1 or 16:1) for the selected index.

Important: Sub-Sampling has no effect when the "Image Dimension" mode is configured as Region of Interest in the Database Mode command. This is because the camera Window of Interest is determined by the software based on the database ROI setup and there is no benefit to sub-sampling to increase speed, as the frame size would have to be increased to account for the sub-sampling.

Top/Left/Height/Width

The image dimension settings can be applied as a Window of Interest or a Region of Interest depending on the image dimension mode selected in the Database Mode command.

Symbol Type

This field allows the user to configure the database to operate on specific symbol types for selected database index. Symbol type-specific parameters must be configured with the appropriate symbol type command. For example fixed length Code 128 is required; it must be set up with the Code 128 command **<K474>**. To configure a symbol type, simply add the number value associated with the symbol type to the field parameter.

Example: If Data Matrix and Code 39 are required the parameter would be 2 + 16 = 18.

Disabled

When disabled, the database uses the current Symbol Type setup to determine active symbol types.

Any Type

All of the preceding symbol types, except Pharmacode, are enabled while this database index is being used.

Data Matrix

If enabled, Data Matrix will be active for this database index.

Important: The ECC Level must be configured using the Data Matrix command **<K479>**. If no ECC level has been configured, then it will not decode a Data Matrix symbol.

QR Code

If enabled, QR Code will be active for this database index.

Code 128

If enabled, Code 128 will be active for this database index.

Code 39

If enabled, Code 39 will be active for this database index.

Interleaved 2of 5

If enabled, Interleaved 2of 5 will be active for this database index.

PDF417

If enabled, PDF417 will be active for this database index.

MicroPDF417

If enabled, MicroPDF417 will be active for this database index.

Pharmacode

If enabled, Pharmacode will be active for this database index.

DataBar-14

If enabled, DataBar-14 will be active for this database index.

DataBar Limited

If enabled, DataBar Limited will be active for this database index.

DataBar Extended

If enabled, DataBar Extended will be active for this database index.

Database and Capture Modes

The configuration database behaves the same for both “Rapid” and “Continuous” Capture Mode, the only discernable difference is in “Rapid” capture mode the database incrementing always operates in “Number of Image Frames” with a “frame count” of 1.

Camera Settings

When the database loads a camera configuration and there is a change in shutter speed (integration time), window of interest (WOI), or sub-sampling from the last image that was captured; Then one image frame needs to be processed to setup the new configuration prior to capturing an image.

The capture will start immediately following the integration period.

If the image dimensions are configured as a Region of Interest (ROI), then a change to these values does not incur the additional image frame since it is no longer a camera setting.

Since some image capture events require that an image frame delay occur and some don’t, this does complicate the image capture time when the Configuration Database is enabled.

Notes:

- If no camera change occurs, the start of the image capture is immediate upon being triggered
- If a camera change occurs, the start of the image capture occurs after the shutter time has completed. In the case above, the image capture would incur a 1ms delay.

Number of Active Indexes

Number of database records (groups of settings) that will be used automatically during the read cycle. If set to 0, the imager only uses the current settings, not database entry settings.

Sort Database

Activates a sort function that move the database entry associated with the last decode to the first position in the database and move all other entries up.

Database Mode

Switch Mode

Selects the event that causes the imager to load the next entry from the database to current, active settings. When timer/count expires and “Image Process Looping” is enabled the next database entry that has a camera modification will be used.

Notes:

Capture event always occurs when the 1st database entry is used.

This setting has no effect in Rapid Capture mode.

Rapid Capture mode always operates in “Number of Frames” mode, with a “Frame Count” = 1.

Time

The imager will load the next entry from the database to current after a defined time interval. The timer will start upon use of a database entry. In other words, if the timer expires during a capture event, the timer will not start again until the database entry has been incremented and the new entry has been loaded to current.

Number of Image Frames

Database index is incremented after the specified number of image frames have been captured.

Frame Count/Time

Indicates the “Number of Frames” that will occur or the amount of “Time” that is required before the imager will load the next database configuration. Timer resolution is 1ms.

Image Process Looping

This feature is useful for processing a captured image frame multiple times with different Image Process/Decode parameters.

Disabled

An image is captured for every database configuration, regardless if a camera setting has been modified.

Enabled

When a database configuration is loaded to current, and the Camera settings have not changed from last capture event, a new image is not captured. But rather the last image frame that was captured is re-processed with the new Image Processing/Decode configuration. The one exception is with the 1st database index, a new image is always captured when the 1st database configuration is used. When a camera setting has been modified from one database setting to the next, a new image is captured. For example, if all database entries contained the same camera setting values, but had different IP/Decode configurations, the only time an image frame would be captured would be when the 1st database configuration was used.

Image Dimensions

This feature defines how the image dimension parameters are implemented.

Window of Interest (WOI)

In this mode the database image dimension parameters are Camera Settings and dictate the size of the image to be captured.

Region of Interest (ROI)

In this mode the database image dimension parameters are Image Processing\Decode Settings and specify the region or area of the captured image to be processed. The ROI coordinate data is based on the full scale image size. The WOI of the captured image will be configured to cover all the active database ROI settings. In the following example there are three active database setting, with different ROI configurations. Their coordinates are based at point 0,0 of the full scale image (SXGA = 1280 x 1024 or VGA = 640 X 480). The image WOI is not configurable, it is automatically setup by the database, based on the ROI settings.

This feature is intended to be used in conjunction with the “Image Process Looping” feature, to allow processing different regions of a captured image with different Image Processing Decode Settings. In addition, if combined with “Output Filtering” the user can order the output of decoded symbols in a captured image frame by their location in the Field of View.

Multiple Symbols with Same Symbol Data Operation

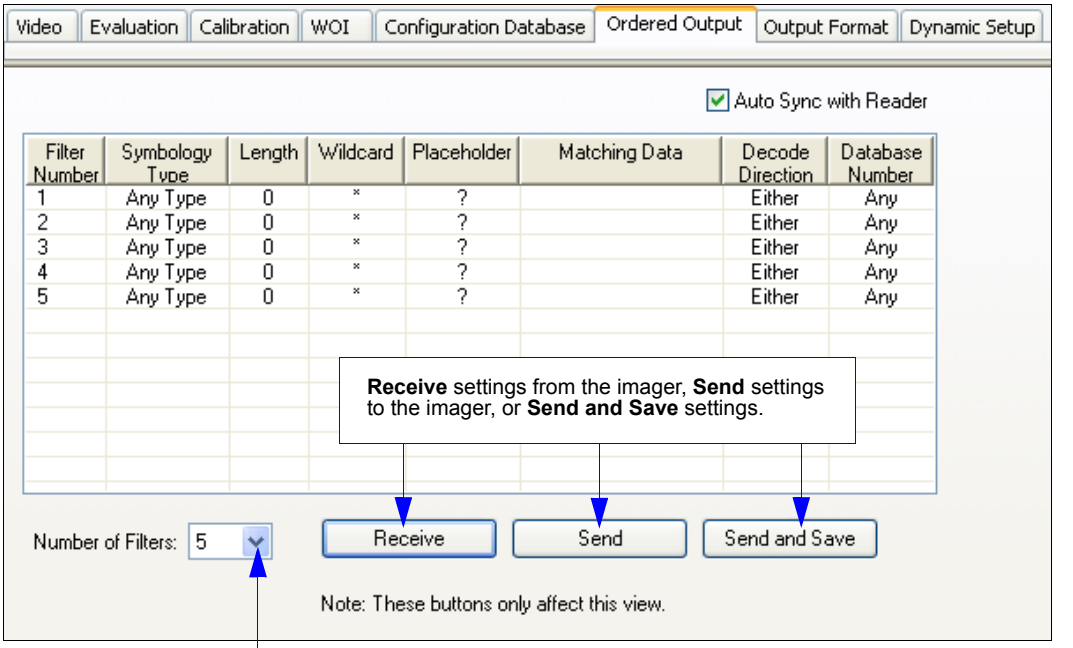
ROI can be used to decode more than one of the same symbols and treat them as different symbols. Multi Symbol Operation will work within the following rules:

- Multiple symbols of same symbol data can only be handled by using ROI mode. This can only be done between different ROI IP Region settings.
- ROI IP Region settings within the database must be sequential (Not Interlaced) in order to correctly know when a new region has been tried. If Database slot 2 and 3 are swapped, the imager would then treat them as 4 separate ROI regions. This would result in 4 different symbols with GDR of 1 instead of 2 different symbols with GDR count of 2.
- ROI Regions will count the same symbol in the same region as additional decodes, but only spanning multiple frames. Each decode of same symbol with same ROI will add to the GDR count with additional frames.
- Multiple symbols can be within each ROI Region but cannot identify multiple Same Symbols. If same symbol is in a ROI twice per frame then it will be counted as 1 decode or 1 more GDR count, the second will be ignored.
- Filtering can only be done with database # because all other data is same.

Ordered Output

Output filtering is a method of providing a set of good read qualifiers and also providing ordered output. There is a filter for up to the first 10 positions in a multisymbol output. The first filter corresponds to the first symbol output at the end of the read cycle. Each filter has settings for the following six parameters: **Filter Number**, **Symbology Type**, **Length**, **Wildcard**, **Placeholder**, **Matching Data**, **Decode Direction**, and **Database Number**.

Filter Number, **Symbology Type**, **Length**, **Wildcard**, **Placeholder**, and **Matching Data** are all displayed in the table below. Double-clicking on any row of the table will display the **Ordered Output Filter Settings** dialog, where settings can be changed.



Number of Filters refers to the number of active output filters. **0** disables all output filters. Any non-zero numeral will enable output filtering to be performed using the filter indexes covered by this value.

For example, if the number of filters is **5**, then filter indexes 1, 2, 3, 4, and 5 will be applied.

Filter Number

This is the filter index number that represents the position of the symbol in the data output at the end of the read cycle. This index number should be entered along with the following filter settings for the predetermined symbol position.

Symbology Type

Specifies the symbology type allowed to occupy this location in multisymbol output.

Note: To filter or order a symbol, the symbol must meet all the requirements of the selected filter index.

Length

Specifies the length of the decoded symbol allowed to occupy this location in multisymbol output.

Note: To filter or order a symbol, the symbol must meet all requirements of the selected filter index.

Wildcard

This is the character to be used in the data output field when performing a data filter comparison. The wildcard character represents the end of matching, and allows for variable lengths of symbol output.

Placeholder

The placeholder character requires a character to be present, but does not compare the data value.

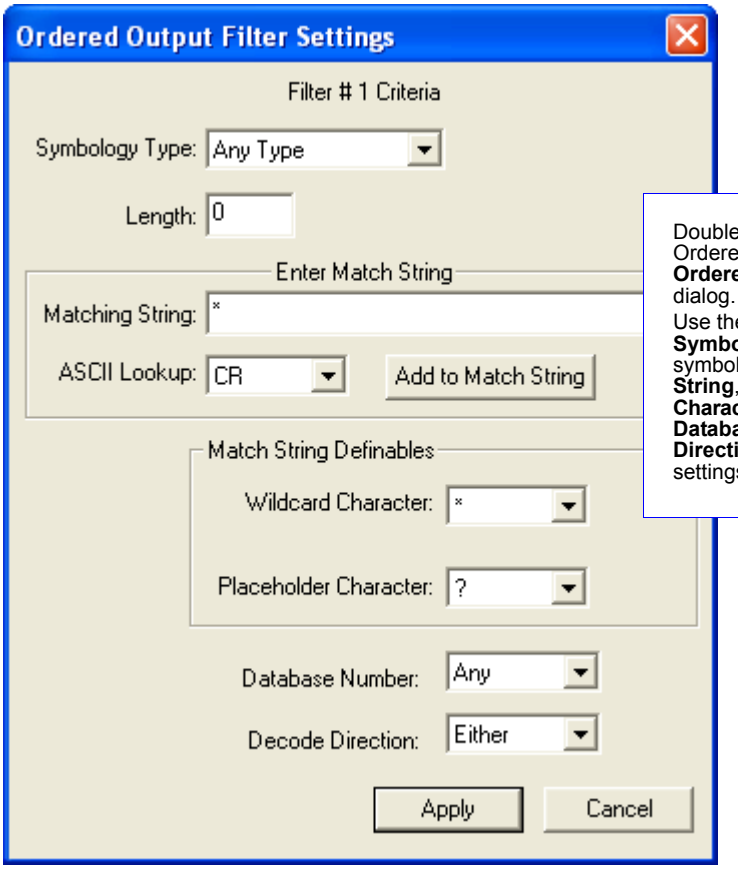
Matching Data

This is the data string to be used when comparing symbol data for output filtering and ordering. This data string may also contain wildcard and placeholder characters to facilitate matching. Remember that in order to filter or order symbol data, it must meet all the requirements of the selected filter index.

Examples:

- Filter data = “123*”. This will match data strings of “123”, “123456”, and “123ABC”, but not “12”.
- Filter data = “123*AB?C”. This will be interpreted as “123*”.
- Filter data = “123?”. This will match “1234” and “123A”, but not “123”, “12345”, or “1234C”.
- Filter data = “123?A”. This will match “1234A” and “123BA”, but not “123”, “1234C”, or “1234ABCD”.
- Filter data = “123?A?”. This will match “1234AB” and “123BAT”, but not “1234A” or “123BATS”.
- Filter data = “12??*”. This will match “1234”, “123456”, and “123ABC”, but not “12” or “123”.
- Filter data = “123?A*”. This will match “1234A”, “123BA”, and “123BATS”, but not “1234” or “1234C”.

Ordered Output Filter Settings



Double-clicking on a row in the Ordered Output table brings up the **Ordered Output Filter Settings** dialog.

Use these settings to determine **Symbology Type**, **Length** of the symbol, a user-defined **Matching String**, **ASCII Lookup**, **Wildcard Character**, **Placeholder Character**, **Database Number**, and **Decode Direction**. Click **Apply** to save the settings to the corresponding filter.

Rules for Output Filter Configuration

Output Filter Configuration Rule # 1

Each symbol that is decoded must match one of the filters before it can be saved to a read cycle record. There is an exception to this rule, however, when the number of symbols required for a read cycle exceeds the number of active filters. In such a case, unfiltered symbols can be placed into unfiltered output positions.

For example, if the number of symbols required is 6 but there are only 5 active filters, the last position can be filled by any (unfiltered) qualified symbol.

Output Filter Configuration Rule # 2

The same filter setup can be used multiple times.

For example, filters 1, 2, and 3 can be set up to filter Code 39 symbols, and the output will occur in the order the symbols are decoded.

Output Filter Configuration Rule # 3

All qualified symbols will be sorted and output in the matching filter position. If a symbol matches filter 3, it will be output as the third symbol. If a filter does not have a matching qualified symbol, a No Read message will be output in place of the symbol (assuming the No Read message is enabled).

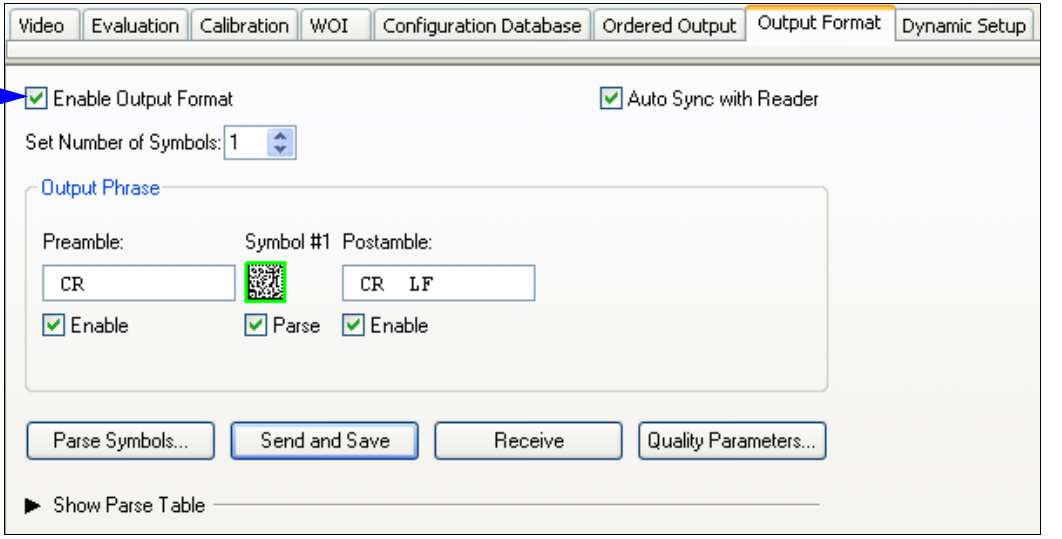
For example, if there is not a symbol that meets filter 3's requirements, then a No Read message will be output in the third output position.

Output Format

Enable Output Format

This is a global enable/disable parameter. Use **Set Number of Symbols** and **Output Phrase** to assign symbols for formatting, and **Symbol Parse** to determine the specific output content for the assigned symbols.

On the **Output Format** tab, check the **Enable Output Format** box.

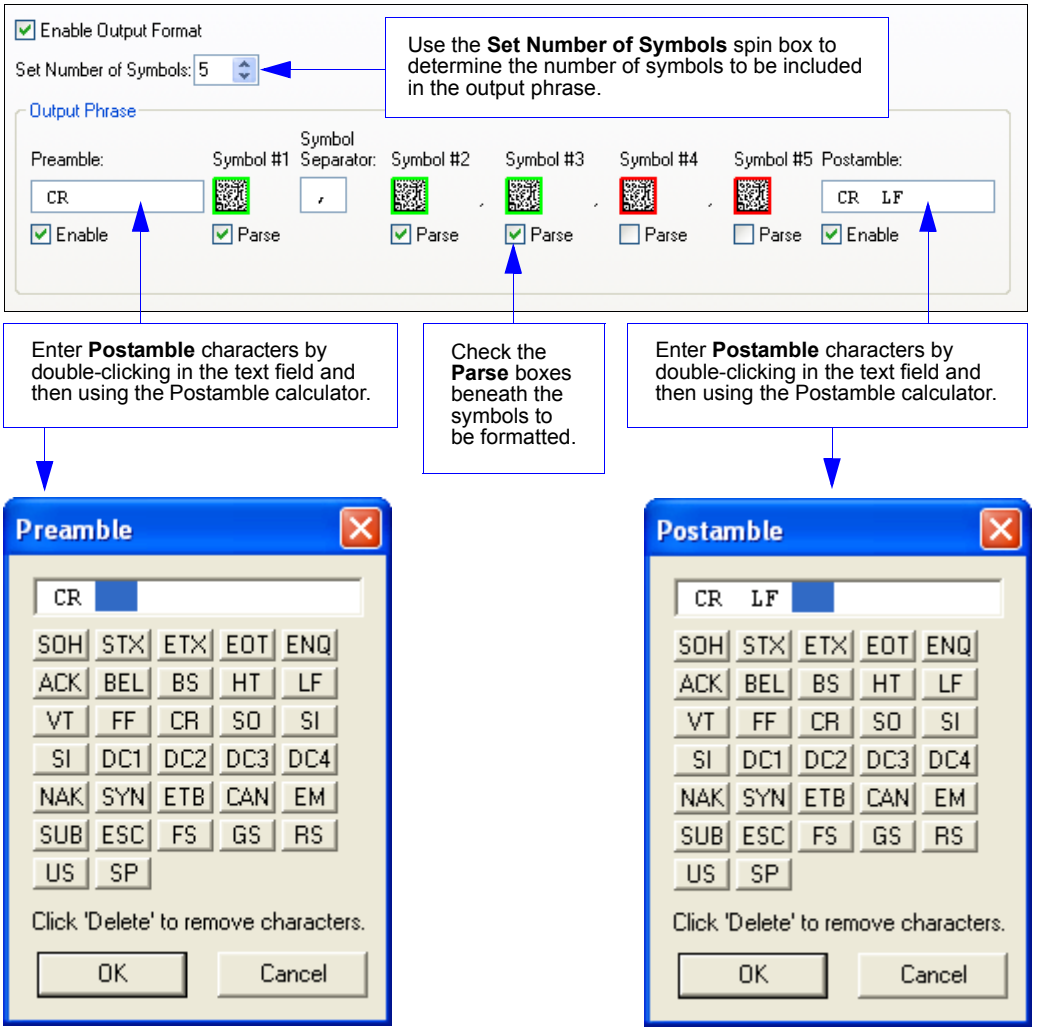


Set Number of Symbols

Number of Symbols determines the number of symbols to which output formatting will apply.

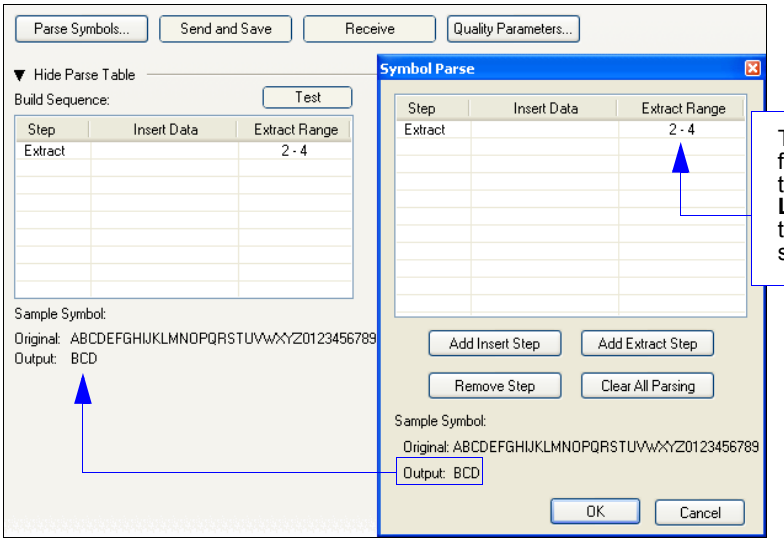
Output Phrase

Output Phrase refers to the user-defined Preamble, selected symbols, and Postamble sequence in the read cycle result.



Symbol Parse

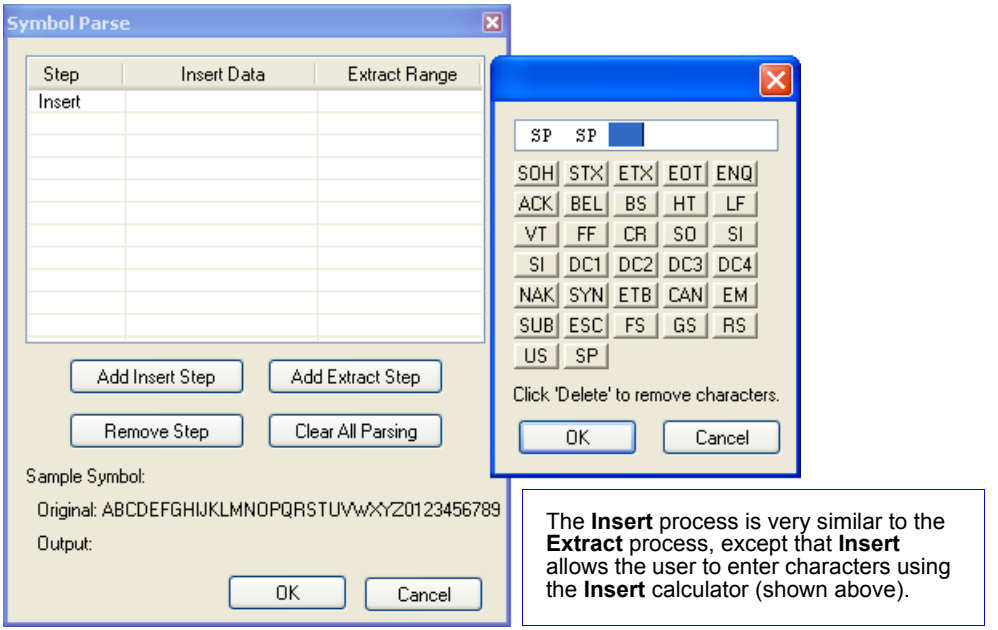
Extract



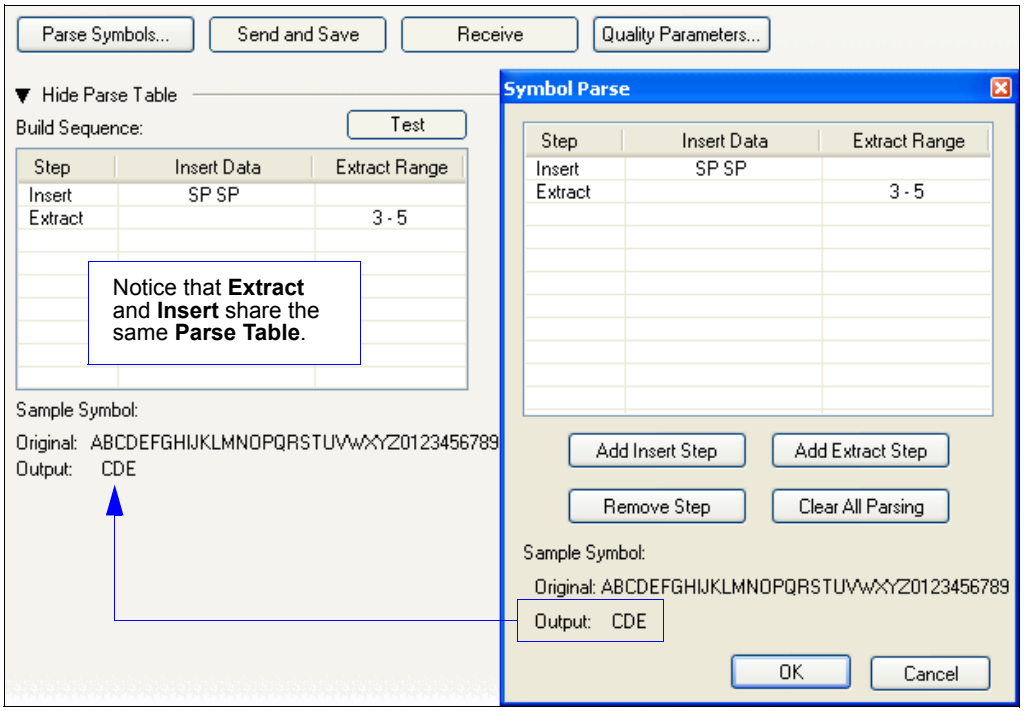
The **Extract Range** function corresponds to the **Start Location** and **Length** parameters in the **Format Extract** serial command.

Multiple character sequences can be extracted and inserted using **Symbol Parse**. In this example, the selected extraction range is characters 2-4. The “Sample Symbol” example on the **Symbol Parse** dialog shows the selected character positions extracted and output as desired. Simultaneously, the data string from the selected symbol is displayed at the bottom left of the **Parse Table**, followed by the user-defined extracted output.

Insert

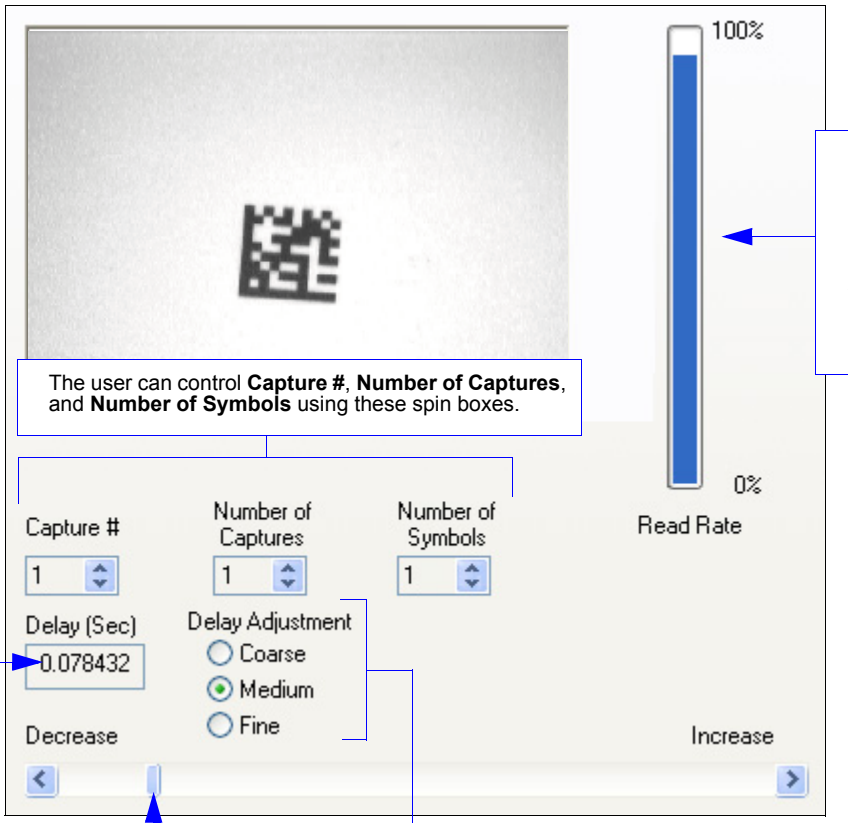


The **Insert** process is very similar to the **Extract** process, except that **Insert** allows the user to enter characters using the **Insert** calculator (shown above).



Dynamic Setup

Dynamic Setup is used to calculate image capture timing during a read cycle. Without proper timing, the imager will not be able to decode all symbols in a read cycle. An external trigger is used to activate image captures so the user can make timing adjustments as capture events occur.



Read Rate is represented graphically in real-time as the user makes adjustments to the time delay between image captures.

The user can control **Capture #**, **Number of Captures**, and **Number of Symbols** using these spin boxes.

The **Delay Adjustment** slider allows the user extremely precise control of the time delays between image captures in a read cycle. Delay values are shown in seconds in the field above the slider. The **Coarse** and **Fine Delay Adjustment** options determine whether larger or smaller adjustment increments will be used.

5 Parameters

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Matchcode 5-162
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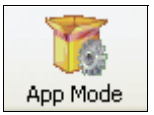
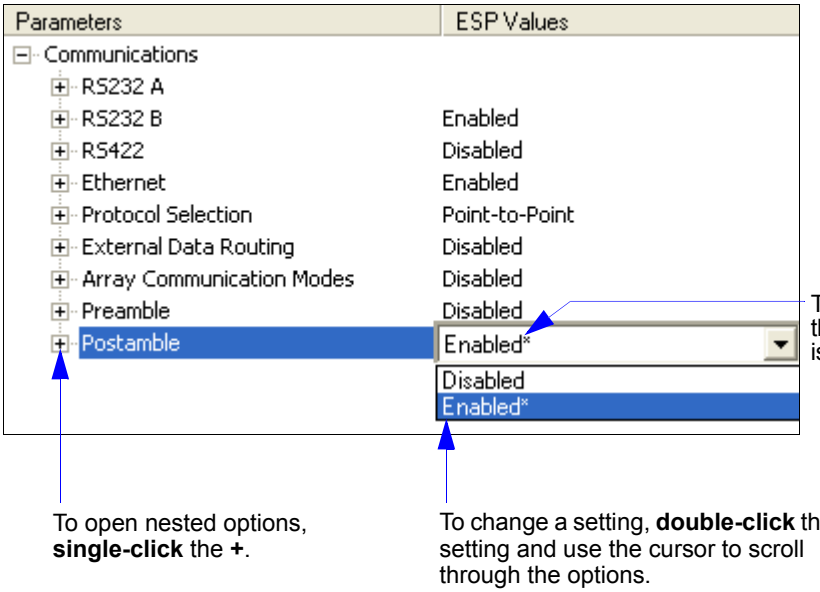
This section explains the function and purpose of the **Parameters** commands in ESP's tabbed tree controls.

Important: Unless otherwise specified, command settings shown in this section are the default settings.

Communication



Click the **App Mode** button and then the **Parameters** button to display the tree control tabs.
Then click the **Communication** tab to display the Communication tree control.



The * indicates that the setting is the default.

To open nested options, **single-click** the **+**.

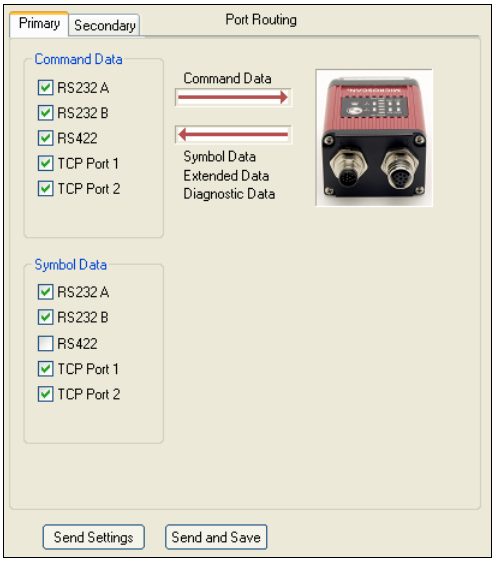
To change a setting, **double-click** the setting and use the cursor to scroll through the options.

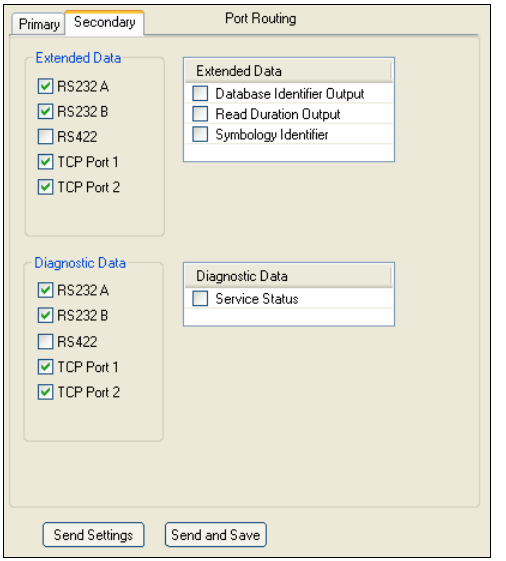
Note: Communication settings can also be sent to the imager from ESP's Terminal using Microscan's K command format. Refer to the **Communication** section of **Appendix E**.

Port Routing

The QX Hawk features a communication system based on **Port Routing** instead of traditional, dedicated serial ports. Decisions can be made about the direction and content of communication between ports based on different **Data Types**. Any available port can be used in any combination.

The fundamental concept of Port Routing is that communication design can be based upon Data Types rather than ports. The advantage of this is the ability to map different data types to different ports—the user is no longer limited to a “Host Port” and “Aux Port” for specific types of input and output. Since each port is independent instead of fixed for a particular purpose, the imager behaves more like a data switch.



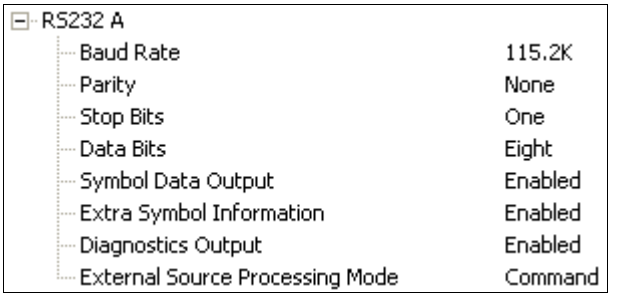


Port Routing Advantages

- Data can be routed in on one port and out on the same port or a different port like a switch or router. **Transparent Mode**, **Half Duplex Mode**, **Full Duplex Mode**, and **Custom Mode**.
- External Data Routing still follows the “To/From Host/Aux” paradigm. The new capability allows the customer to define the data direction—which port behaves as the “Host Port” and which port behaves as the “Aux Port”.
- Only one daisy chain setup required per system.
- Minimal configuration required for each port, with similar items grouped together.

RS-232 A

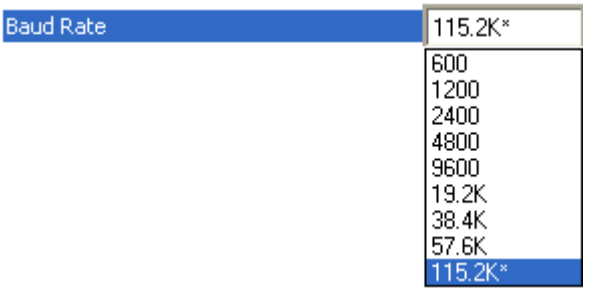
The following settings define the basic transmission speeds and digital standards that ensure common RS-232 formatting.



Baud Rate

Can be used to transfer data faster or to match host port settings.

The rate at which the imager and host transfer data back and forth.



Parity

Only changed if necessary to match host setting.

An error detection routine in which one data bit per character is set to **1** or **0** so that the total number of bits in the data field is either even or odd.

Stop Bits

Only changed if necessary to match host setting.

One or two bits added to the end of each character to indicate the end of the character.

Data Bits

Only changed if necessary to match host setting.

One or two bits added to the end of each character to indicate the end of the character.

Symbol Data Output

Enables or disables decoded symbol data output from the imager.

Extra Symbol Information

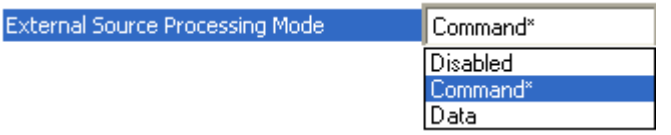
Enables or disables extra symbol information output from the imager.

Diagnostics Output

Enables or disables diagnostics output from the imager.

External Source Processing Mode

Enables or disables processing of commands or data from sources external to the imager.



Command

Command enables command processing in the imager.

Note: Command processing is always enabled for **RS-232 A**.

Data

Data enables RS-232 A as a data source port.

Note: The data path between **in** the source port and **out** the source port is always two-way. Data is copied from source data ports and all those source ports' data is transmitted to the destination port, and from the destination port to the source port.

RS-232 B

The following settings define the basic transmission speeds and digital standards that ensure common RS-232 formatting.

RS232 B	Enabled
Baud Rate	115.2K
Parity	None
Stop Bits	One
Data Bits	Eight
Symbol Data Output	Enabled
Extra Symbol Information	Enabled
Diagnostics Output	Enabled
External Source Processing Mode	Command

Baud Rate

Can be used to transfer data faster or to match host port settings.

The rate at which the imager and host transfer data back and forth.

Parity

Only changed if necessary to match host setting.

An error detection routine in which one data bit per character is set to **1** or **0** so that the total number of bits in the data field is either even or odd.

Stop Bits

Only changed if necessary to match host setting.

One or two bits added to the end of each character to indicate the end of the character.

Data Bits

Only changed if necessary to match host setting.

One or two bits added to the end of each character to indicate the end of the character.

Symbol Data Output

Enables or disables decoded symbol data output from the imager.

Extra Symbol Information

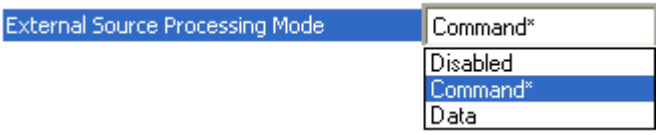
Enables or disables extra symbol information output from the imager.

Diagnostics Output

Enables or disables diagnostics output from the imager.

External Source Processing Mode

Enables or disables processing of commands or data from sources external to the imager.



Command

Command enables command processing in the imager.

Data

Data enables RS-232 B as a data source port.

Note: The data path between **in** the source port and **out** the source port is always two-way. Data is copied from source data ports and all those source ports' data is transmitted to the destination port, and from the destination port to the source port.

RS-422

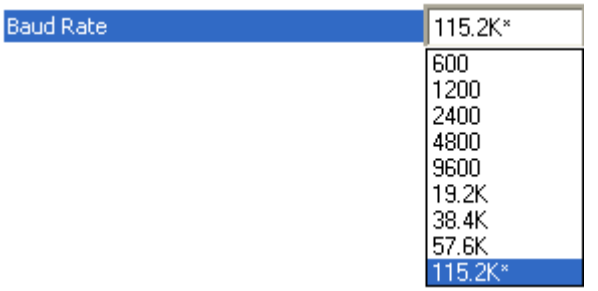
The following settings define the basic transmission speeds and digital standards that ensure common RS-422 formatting.

RS422	Disabled
Baud Rate	115.2K
Parity	None
Stop Bits	One
Data Bits	Eight
Symbol Data Output	Disabled
Extra Symbol Information	Disabled
Diagnostics Output	Disabled
External Source Processing Mode	Command

Baud Rate

Can be used to transfer data faster or to match host port settings.

The rate at which the imager and host transfer data back and forth.



Parity

Only changed if necessary to match host setting.

An error detection routine in which one data bit per character is set to **1** or **0** so that the total number of bits in the data field is either even or odd.

Stop Bits

Only changed if necessary to match host setting.

One or two bits added to the end of each character to indicate the end of the character.

Data Bits

Only changed if necessary to match host setting.

One or two bits added to the end of each character to indicate the end of the character.

Symbol Data Output

Enables or disables decoded symbol data output from the imager.

Extra Symbol Information

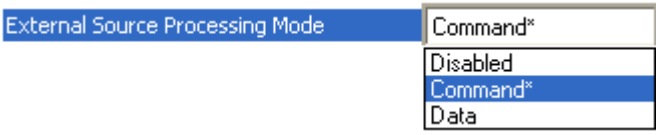
Enables or disables extra symbol information output from the imager.

Diagnostics Output

Enables or disables diagnostics output from the imager.

External Source Processing Mode

Enables or disables processing of commands or data from sources external to the imager.



Command

Command enables command processing in the imager.

Data

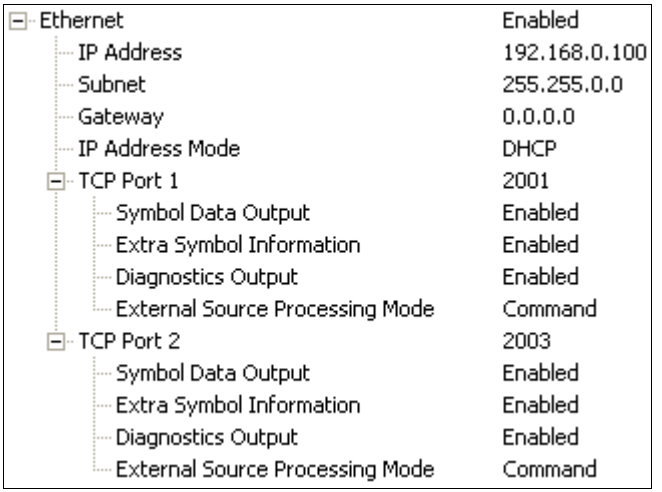
Data enables RS-422 as a data source port.

Note: The data path between **in** the source port and **out** the source port is always two-way. Data is copied from source data ports and all those source ports' data is transmitted to the destination port, and from the destination port to the source port.

Ethernet

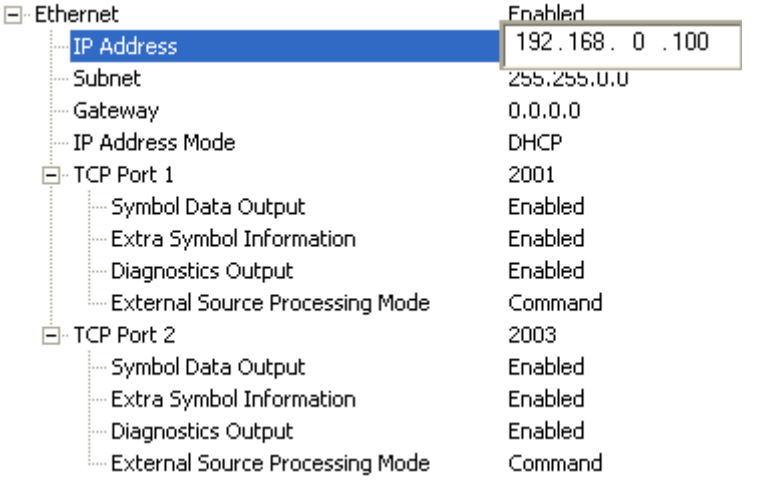
Enables or disables Ethernet connectivity in the imager.

Important: For further information about setting up TCP/IP with a PC, see Appendix H – **Configuring Ethernet TCP/IP**.



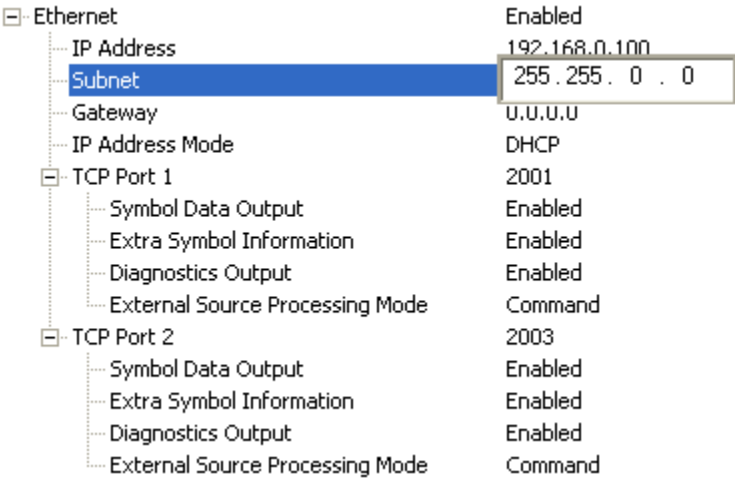
IP Address

Enter the IP address of the imager in this field.



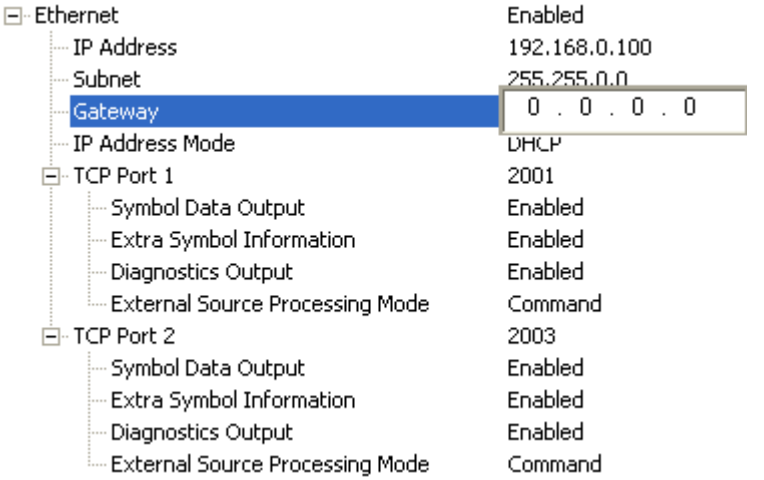
Subnet

Enter the Subnet address of the imager in this field.



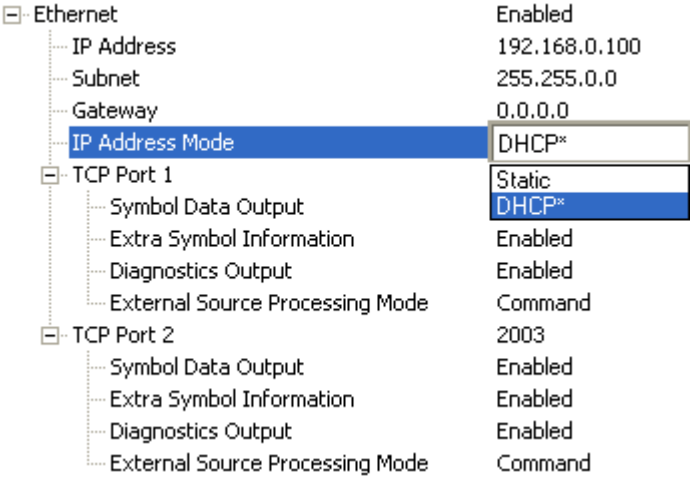
Gateway

Enter the Gateway address of the imager in this field.



IP Address Mode

Determines how the imager's IP address will be defined.



Static

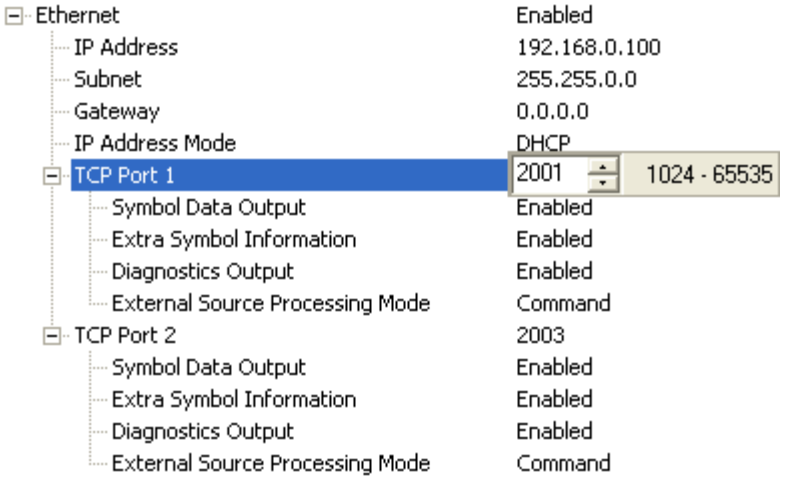
In **Static Mode**, the imager uses the user-defined IP address entered in ESP.

DHCP

In **DHCP Mode**, the imager automatically acquires the IP address, Subnet, and Gateway addresses from a DHCP or BOOTP server.

TCP Port 1

One of two TCP ports for Ethernet communication with the imager. The default setting is **2001**.



Symbol Data Output

Enables or disables decoded symbol data output from the imager.

Extra Symbol Information

Enables or disables extra symbol information output from the imager.

Diagnostics Output

Enables or disables diagnostics output from the imager.

External Source Processing Mode

Enables or disables processing of commands or data from sources external to the imager.

Command

Command enables command processing in the imager.

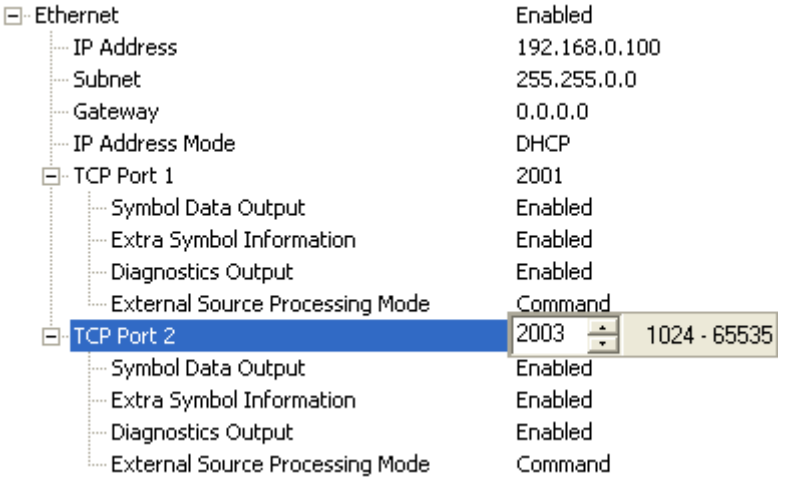
Data

Data enables Ethernet TCP Port 1 as a data source port.

Note: The data path between **in** the source port and **out** the source port is always two-way. Data is copied from source data ports and all those source ports' data is transmitted to the destination port, and from the destination port to the source port.

TCP Port 2

One of two TCP ports for Ethernet communication with the imager. The default setting is **2003**.



Symbol Data Output

Enables or disables decoded symbol data output from the imager.

Extra Symbol Information

Enables or disables extra symbol information output from the imager.

Diagnostics Output

Enables or disables diagnostics output from the imager.

External Source Processing Mode

Enables or disables processing of commands or data from sources external to the imager.

Command

Command enables command processing in the imager.

Data

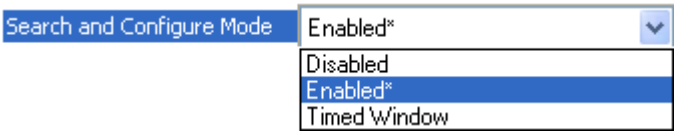
Data enables Ethernet TCP Port 2 as a data source port.

Note: The data path between **in** the source port and **out** the source port is always two-way. Data is copied from source data ports and all those source ports' data is transmitted to the destination port, and from the destination port to the source port.

Search and Configure Mode

Search and Configure Mode is intended for troubleshooting and test purposes. The Ethernet PHY should be able to operate in fully automatic mode at all times. None of this command's parameters are saved in NOVRAM. All parameters are set to default on power on.

A Reset **<A>** is required for settings to take effect.



Enabled

When enabled, **Search and Configure Mode** will find the imager and settings can be changed.

Timed Window

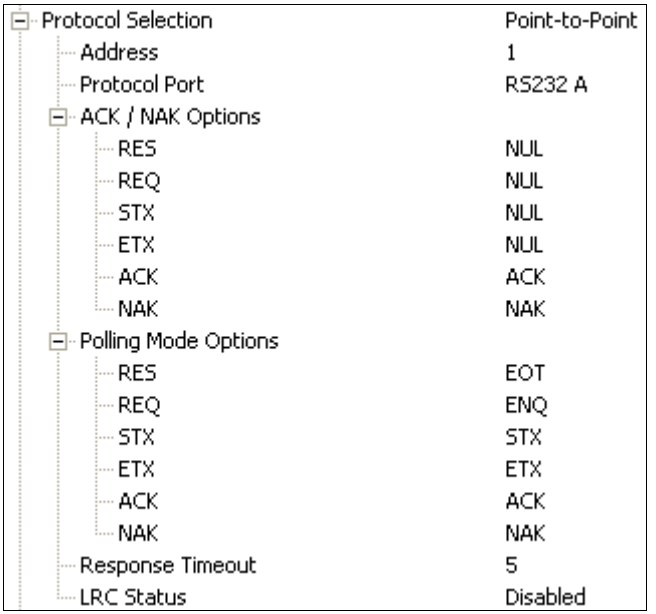
When **Timed Window** is selected, Search and Configure Mode will find the imager and settings can be changed, but only 60 seconds from the last reset. After 60 seconds, Search and Configure Mode will be disabled.

Protocol Selection

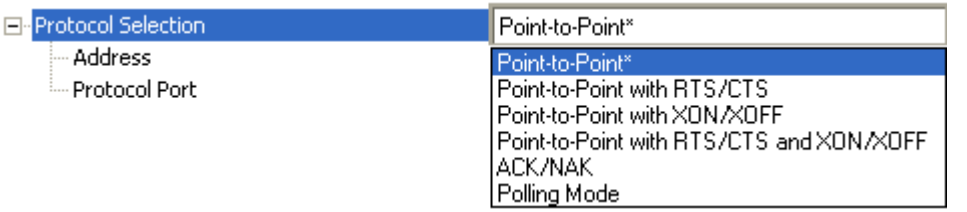
In general, the point-to-point protocols will work well in most applications. They require no address and must use RS-232 or RS-422 communication standards.

Protocols define the sequence and format in which information is transferred between the imager and the host, or in the case of **Multidrop**, between the imagers and a concentrator.

Note: In all protocol modes, the **Preamble** and **Postamble** character strings can be used to frame the decoded data, and both are included in calculating the **LRC** (Longitudinal Redundancy Check).



Protocol Options



Point-to-Point (Standard)

Used only with RS-232 or RS-422.

Standard **Point-to-Point** requires no address and sends the data to the host whenever it is available, without a request or handshake from the host.

Point-to-Point with RTS/CTS

A scanner initiates a data transfer with an RTS (request-to-send) transmission. The host, when ready, responds with a CTS (clear-to-send) and the data is transmitted. RTS and CTS signals are transmitted over two dedicated wires as defined in the RS-232 standard. Used only with RS-232.

Point-to-Point with RTS/CTS (request-to-send/clear-to-send) is a simple hardware handshake protocol that allows a scanner to initiate data transfers to the host.

Point-to-Point with XON/XOFF

If an XOFF has been received from the host, data will not be sent to the host until the host sends an XON. During the XOFF phase, the host is free to carry on other chores and accept data from other devices. Used only with RS-232.

This option enables the host to send the XON and XOFF command as a single byte transmission command of start (**^Q**) or stop (**^S**).

Point-to-Point with RTS/CTS and XON/XOFF

Used only with RS-232.

This option is a combination of **Point-to-Point with RTS/CTS** and **Point-to-Point with XON/XOFF**.

ACK/NAK

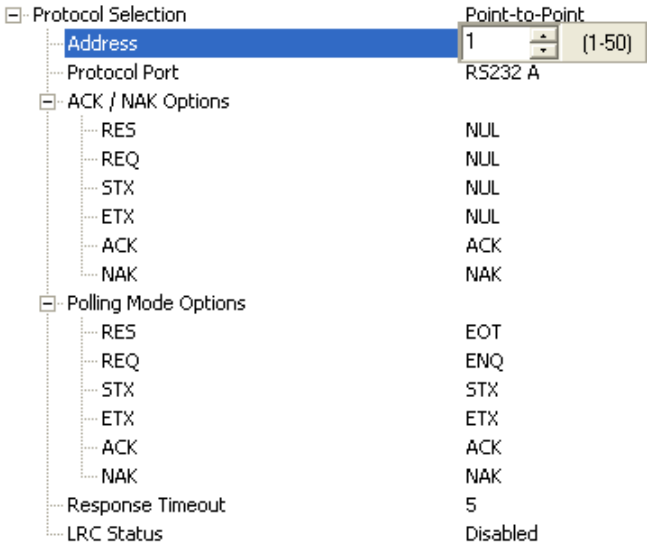
See **ACK / NAK Options**.

Polling Mode

See **Polling Mode Options**.

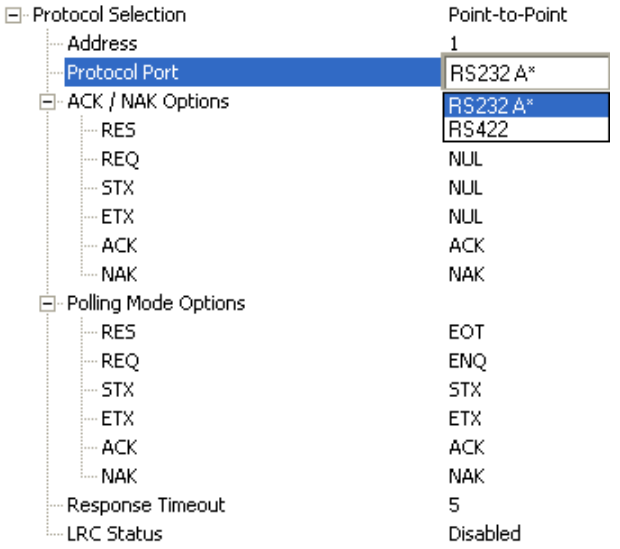
Address

The **Protocol Address** can be any number between **1** and **50**.



Protocol Port

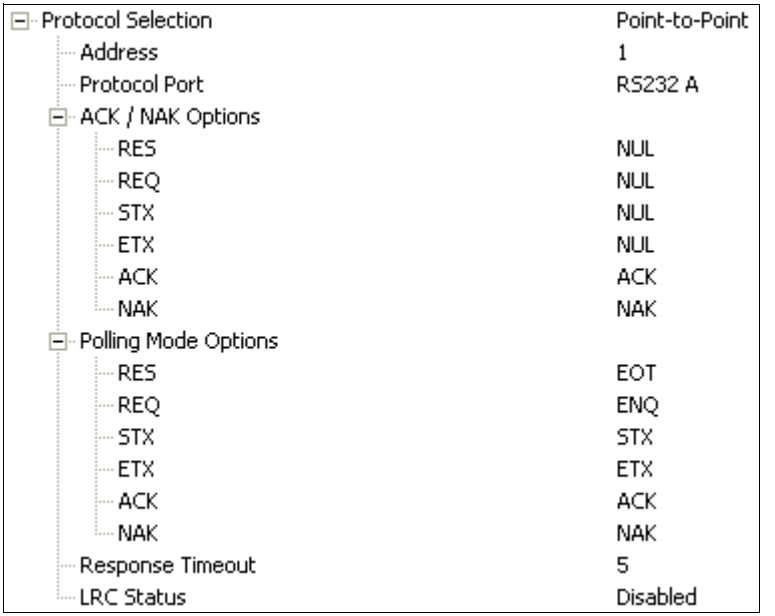
RS-232 A or **RS-422** can be used as **Protocol Ports**.



ACK / NAK Options

These parameters take effect for **ACK/NAK** on the main RS-232 or RS-422 ports (not on the Auxiliary Port), and are completely independent of the **Polling Mode Options**.

The imager always follows the protocol in both directions (to and from the host). There is no option to disable it from either direction.



RES-NAK Defaults

RES: (Reset)	NUL (0x00)
REQ: (Request)	NUL (0x00)
STX: (Start of Text)	NUL (0x00)
ETX: (End of Text)	NUL (0x00)
ACK: (Acknowledge)	ACK (0x06)
NAK: (Negative Acknowledge)	NAK (0x15)

ACK/NAK Protocol

The following are general outlines of the **ACK/NAK** protocol. Items that are framed by brackets (**[ ]**) can either be disabled or enabled. LRC does not include STX, but it does include preamble, postamble, and ETX.

Symbol Data Output

TX to host: [STX] [preamble] SYMBOL DATA [postamble] [ETX] [LRC]

Response from host: ACK/NAK. Sent when LRC, ETX, postamble, or timeout (waiting for more data) are detected (if REQ is disabled) depending on what is enabled.

Commands from Host to Imager

TX to Imager: [STX] <command> [ETX] [LRC]

Response from Imager: ACK/NAK. Sent when LRC, ETX, or command-ending angle bracket '**>**' are received, depending on what is enabled.

Command Response from Imager to Host

TX to host: [STX] [preamble] COMMAND RESPONSE DATA [postamble] [ETX] [LRC]

Response from host: ACK/NAK. Sent when LRC, ETX, postamble, command-ending angle bracket '**>**', or timeout (waiting for more data) are detected, depending on what is enabled.

As with **Polling Mode <K140,5>**, the imager can optionally perform the REQ and RES event sequences in ACK/NAK mode. If the sender does not receive an ACK or NAK, it will send REQ to request such a response (if enabled). When the sender receives an ACK, too many NAKs, or times out (if already enabled), it will send a RES (if enabled) to terminate the transaction.

Note: See **ACK/NAK Data Flow Examples** in Appendix F for sample ACK/NAK communication scenarios.

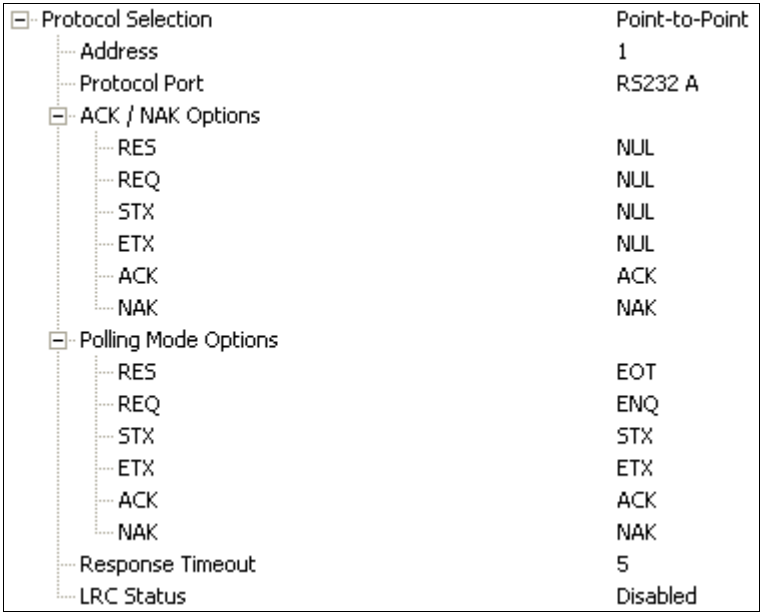
Polling Mode Options

These parameters only take effect for **Polling Mode <K140,5>** on the main RS-232 or RS-422 ports (not on the Auxiliary Port), and are completely independent of the **ACK/NAK Options <K147>**.

The values of protocol characters can be changed, but the protocol events cannot be disabled. The polling mode address is configured in the **<K140>** command.

To enable true multidrop protocol, the RS422/485 port must be enabled, **<K102,1>**, in order to turn the transmitter on and off. If RS-232 is enabled instead of RS422/485, **<K102,0>**, then **Polling Mode** will operate as a **Point-to-Point** polling protocol. This is because the RS-232 transmitter is always left on when enabled.

Note: See **ACK/NAK Data Flow Examples** in Appendix F for sample **Polling Mode** communication scenarios.



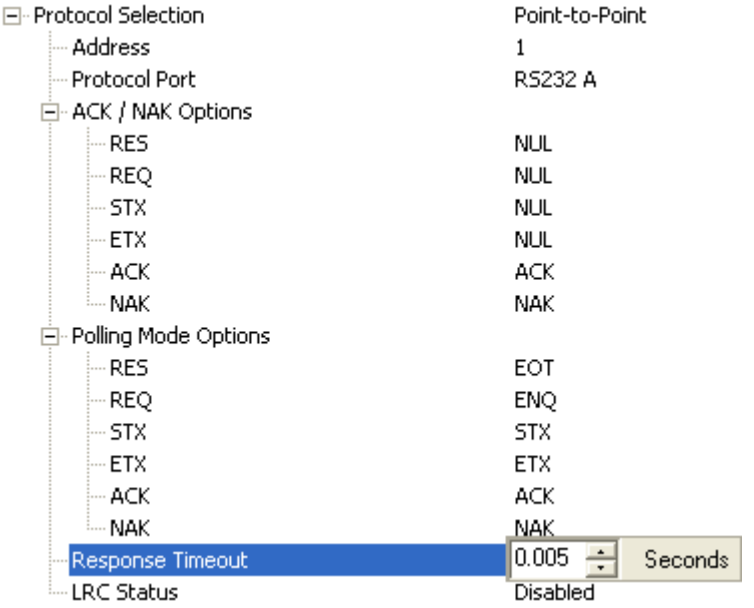
RES-NAK Defaults

RES: (Reset)	EOT (0x04)
REQ: (Request)	ENQ (0x05)
STX: (Start of Text)	STX (0x02)
ETX: (End of Text)	ETX (0x03)
ACK: (Acknowledge)	ACK (0x06)
NAK: (Negative Acknowledge)	NAK (0x15)

Response Timeout

Only used when a response is required from the host. While in **Multidrop**, if the imager does not receive an **ACK** or **NAK** from the host after sending polled data, it will act on a fault. The imager can be set to wait indefinitely by setting **Response Timeout** to zero.

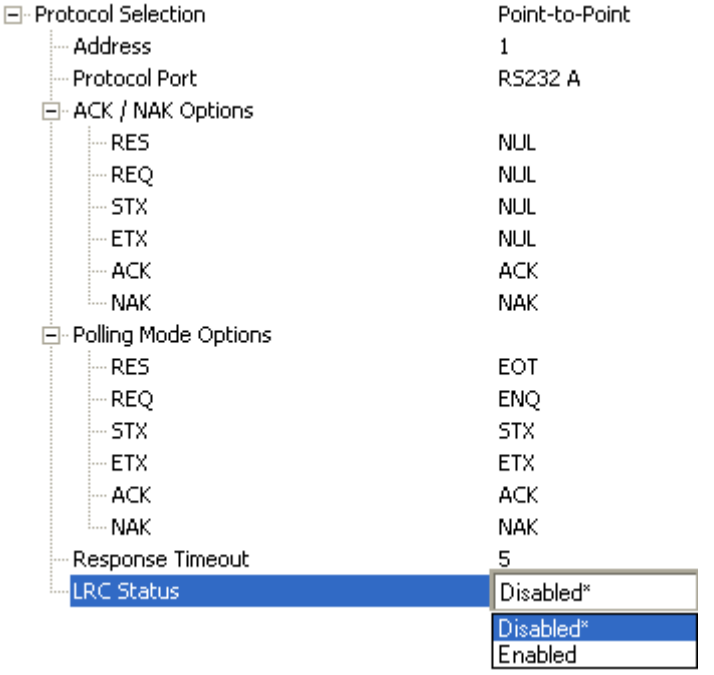
The time that the imager will wait before timing out if **ACK**, **NAK**, and **ETX** are enabled, and a host response is expected.



LRC Status

Used when extra data integrity is required.

An error-checking routine that verifies the accuracy of transmissions. It is the exclusive OR of all characters following the **STX** (start of text) up to and including the **ETX** (end of text). What this means is that the binary representation of all the characters in a transmission are cumulatively added in a column and each resulting odd integer is assigned a 1 and each even integer a 0 (two 1s = 0, two 0s = 0, a 1 and a 0 = 1). The extra LRC character is then appended to the transmission, and the receiver (usually the host) performs the same addition and compares the results.

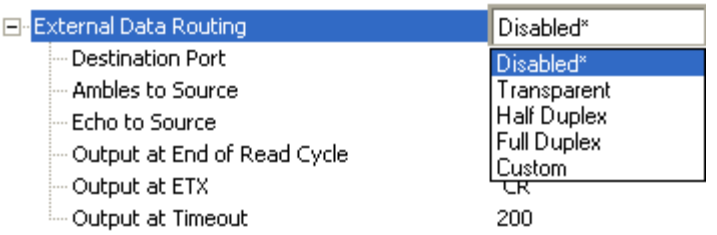


External Data Routing

External Data Routing settings configure the global operation of all external data port settings.

External Data Routing	Disabled
Destination Port	RS232 A
Ambles to Source	Disabled
Echo to Source	Disabled
Output at End of Read Cycle	Disabled
Output at ETX	CR
Output at Timeout	200

External Data Routing Options



Transparent Mode

When **Transparent Mode** is enabled, the following conditions apply:

Symbol Data to Source = Fixed to **Enabled**

Ambles to Source = Fixed to **Disabled**

Echo to Source = Fixed to **Enabled**

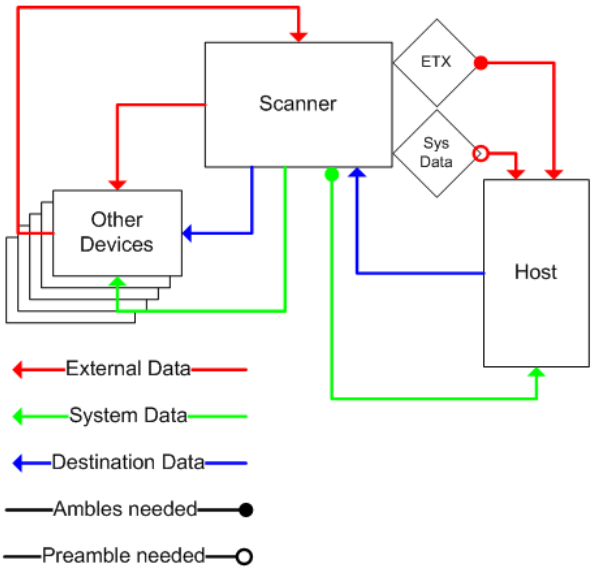
Output at End of Read Cycle = Fixed to **Enabled**

Output at ETX = Fixed to **Enabled** with user-defined characters. Default character will be used if this setting is set to Disabled.

Output at Timeout = Fixed to **Enabled** with user-defined timeout. Default time will be used if this setting is set to Disabled.

Mode of Operation

- Source Port data will echo back to itself.
- Source Port data will always pass through even when the Destination Port is in Polling Mode with the host.
- Whenever ETX is received on the Source Port or symbol data is generated, the data will be send to the Destination Port with its data appearing between the Preamble and symbol data.
- Source Port data will always be sent to the Destination Port with a Preamble and Postamble.
- Symbol data will be sent to the Source Port on a good read without Preamble or Postamble in Point-to-Point protocol even if the Destination Port is in Polling Mode with the host.
- Destination Port data always echoes to the Source Port even if the Destination Port is in Polling Mode.



Half Duplex Mode

When **Half Duplex Mode** is enabled, the following conditions apply:

Symbol Data to Source = Fixed to **Enabled**

Ambles to Source = Fixed to **Enabled**

Echo to Source = Fixed to **Disabled**

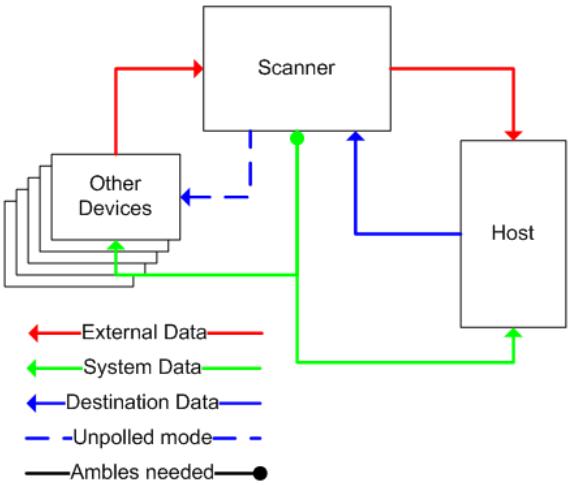
Output at End of Read Cycle = Fixed to **Disabled**

Output at ETX = Fixed to **Disabled** with user-defined characters. Default character will be used if this setting is set to Disabled.

Output at Timeout = Fixed to **Disabled** with user-defined timeout. Default time will be used if this setting is set to Disabled.

Mode of Operation

- Source Port data is not echoed back to itself.
- Source Port data is ignored when the Destination Port is in Polling Mode.
- Source Port data or symbol data is sent to the Destination Port whenever it is received.
- Source Port data is sent to the Destination Port without a Preamble or Postamble.
- Symbol data is sent to the Source Port and the Destination Port at the same time, and conforms to the communication parameters.
- Destination Port data is echoed to the Source Port in an un-polled mode.



Full Duplex Mode

When **Full Duplex Mode** is enabled, the following conditions apply:

Symbol Data to Source = Fixed to **Disabled**

Ambles to Source = Fixed to **Disabled**

Echo to Source = Fixed to **Disabled**

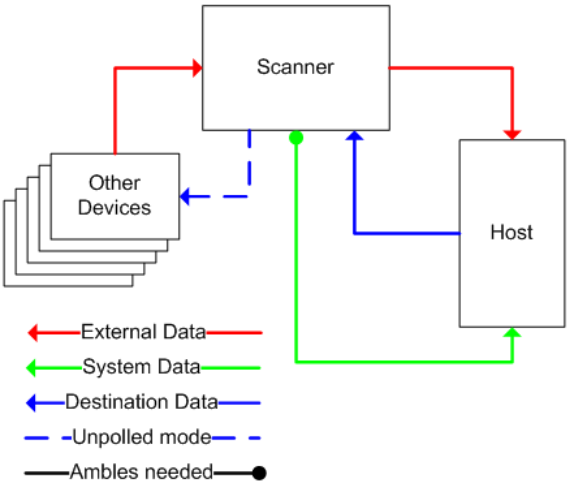
Output at End of Read Cycle = Fixed to **Disabled**

Output at ETX = Fixed to **Disabled** with user-defined characters. Default character will be used if this setting is set to Disabled.

Output at Timeout = Fixed to **Disabled** with user-defined timeout. Default time will be used if this setting is set to Disabled.

Mode of Operation

- Source Port data is not echoed back to itself.
- Source Port data is ignored when the Destination Port is in Polling Mode.
- Source Port data or symbol data is sent to the Destination Port whenever it is received.
- Source Port data is always sent to the Destination Port without a Preamble or Postamble.
- Symbol data is not sent to the Source Port.
- Destination port data is echoed to the source port in an un-polled mode.

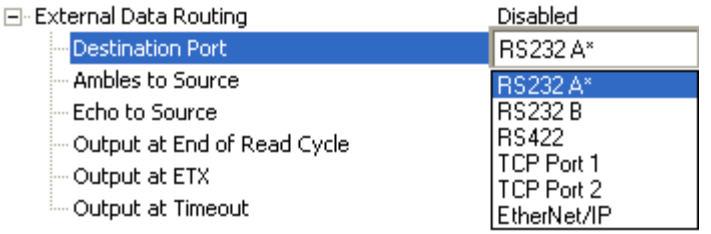


Custom Mode

Custom allows for user-defined communication (Ambles to Source, Echo to Source, Output at End of Read Cycle, Output at ETX, Output at Timeout).

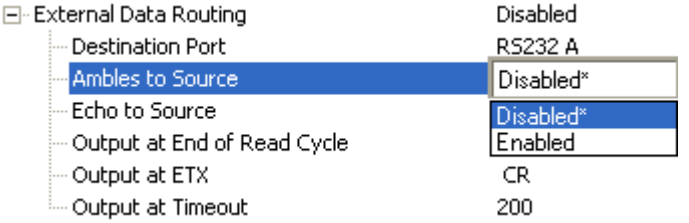
Destination Port

Determines the port to which data will be sent.



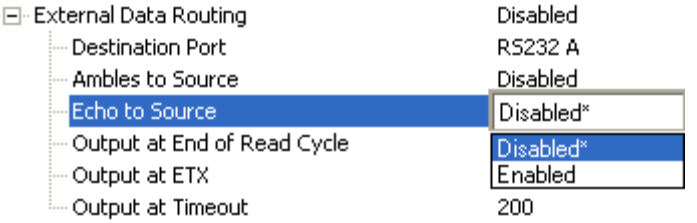
Ambles to Source

Enables or Disables the ability to send Preambles and Postambles to the Source port.



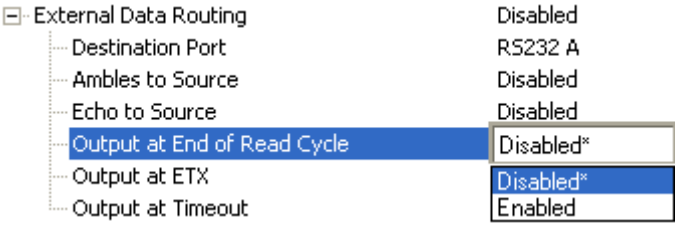
Echo to Source

Enables or Disables the ability to send an Echo to the Source port.



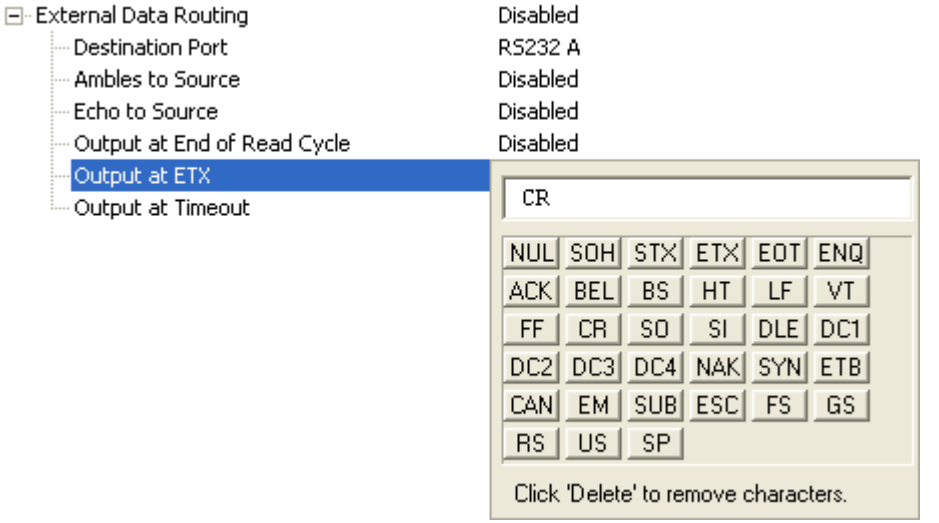
Output at End of Read Cycle

Enables or Disables the ability to output data at the end of read cycle.



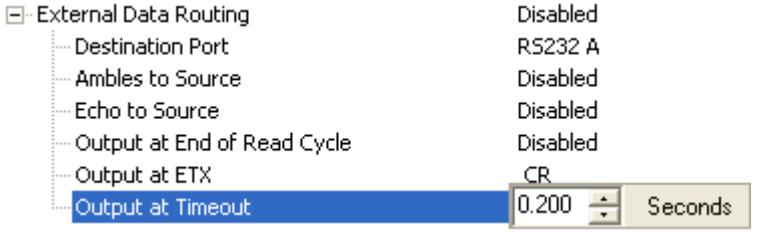
Output at ETX

Determines the output at ETX.

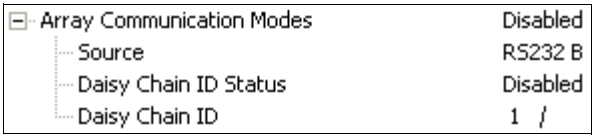


Output at Timeout

Determines the Timeout value for output.



Array Communication Modes

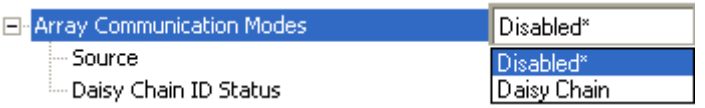


Mode

Daisy Chain

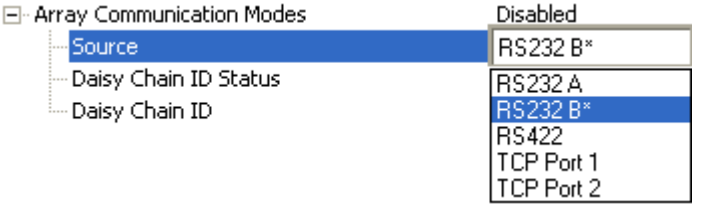
When set to **Daisy Chain**, follows Microscan Daisy Chain protocol.

Note: Daisy Chain can also be autoconfigured by sending the **Daisy Chain Autoconfigure** serial command.



Source

Defines the communication port.

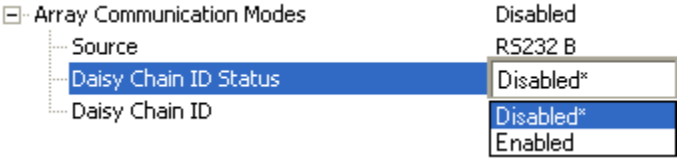


Daisy Chain ID Status

When enabled, the imager will append a two-character prefix to each imager in the array. This allows the user to identify which imager sent the data.

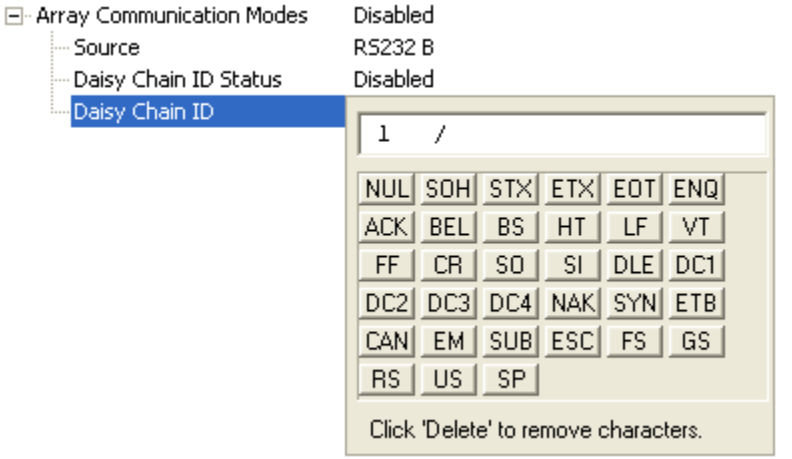
Note: Daisy Chain ID will automatically disable Symbol Data Output, Extra Symbol Information, and Diagnostics Output for the Source Port.

Symbol Data Output will be automatically enabled, Extra Symbol Information will be automatically enabled, and Diagnostics Output will be automatically disabled for the Destination Port.



Daisy Chain ID

The **Daisy Chain ID** is a two-character identifier.



Daisy Chain Autoconfigure

For quick setup of a daisy chain configuration.

The command to **Autoconfigure** the daisy chain is sent to the primary imager and the software responds in the following ways:

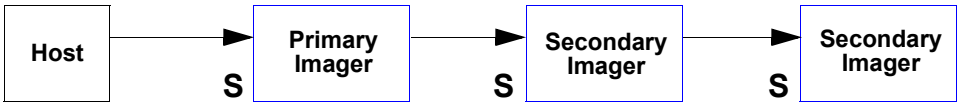
- Counts the number of secondary imagers in the daisy chain.
- Assigns an internal ID number (1...n) to each secondary imager, where the first secondary imager is number **1** (the primary imager's ID being a **0**).
- Propagates the communication settings and the relevant operating modes of the primary imager to the ports of each secondary imager.
- Resets each secondary imager.
- Confirms that each secondary imager has acquired the new settings.

When setting up a daisy chain operation, perform the following steps:

1. Set the primary imager (the one connected to the host) to **Serial Data** Trigger Mode. This sets all the imagers in the chain to **Serial Data** when the command is executed.

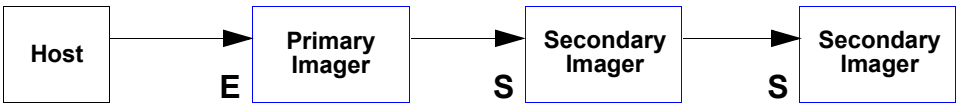
   Important: All secondary imagers must be set to **Serial Data** Trigger Mode for **Daisy Chain** to function.

   Before **Autoconfigure**, the primary imager must be set to **Serial** (**S**):



2. Send the **<K150DAISY>** command from ESP's Terminal.
3. If necessary, set the primary imager to **External Edge**.

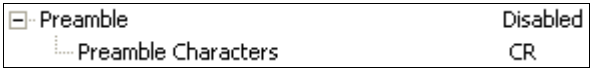
   After **Autoconfigure**, the primary imager can be set to **External Edge** (**E**), but the other imagers must remain in **Serial** (**S**):



   Important: If the imager is Ethernet-enabled, first check to determine if **RS-232 B** is available. If it is available, set RS-232 B as the **Source** port in **Array Communication Modes**. Otherwise, set RS-232 A as the Source port. Port Routing for Symbol Data Output and Extra Symbol Information will be disabled on the Source port.

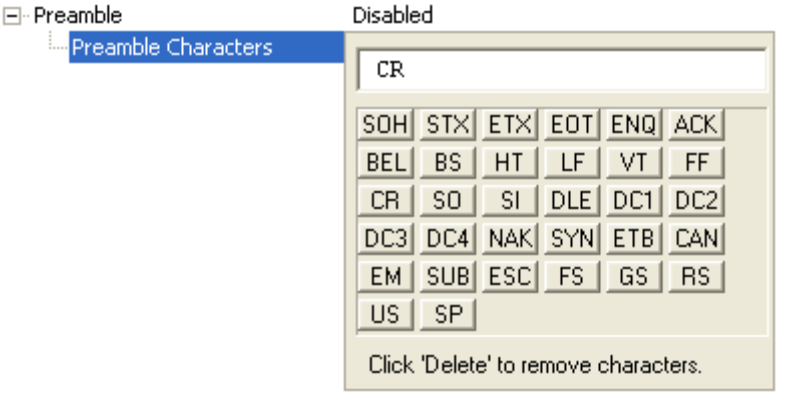
Preamble

Useful for identifying and controlling incoming data. For example, defining the preamble as a carriage return and a line feed causes each decoded message to be displayed on its own line.



Preamble Characters

Allows the user to define up to four postamble characters that can be added to the end of the decoded data

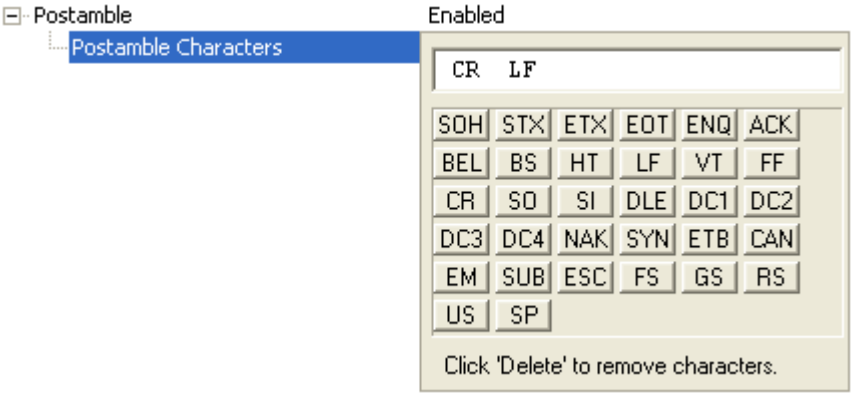


Postamble

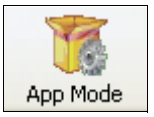
Useful for identifying and controlling incoming data. For example, defining the postamble as a carriage return and a line feed causes each decoded message to be displayed on its own line.

Postamble Characters

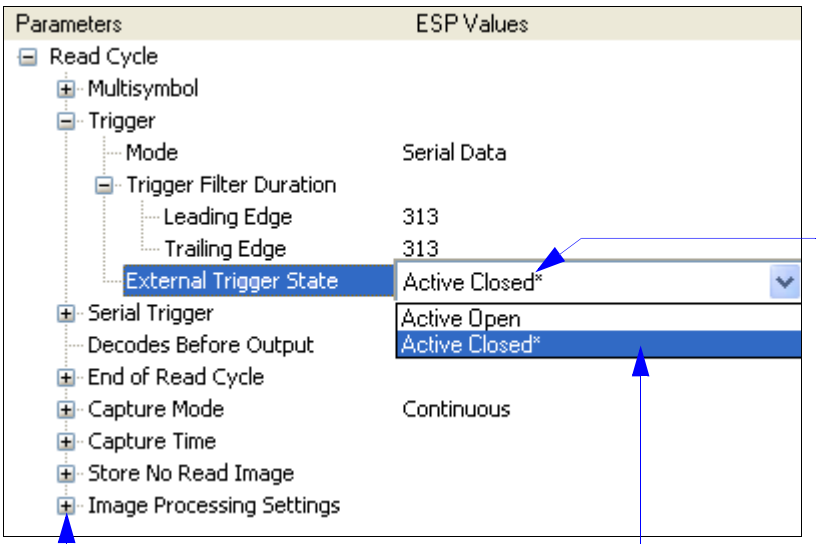
Allows the user to define up to four postamble characters that can be added to the end of the decoded data.



Read Cycle



Click the **App Mode** button and then the **Parameters** button to display the tree control tabs.
Then click the **Read Cycle** tab to display the Read Cycle tree control.



The * indicates that the setting is the default.

To open nested options, **single-click** the **+**.

To change a setting, **double-click** the setting and use the cursor to scroll through the options.

Note: Read Cycle settings can also be sent to the imager from ESP's Terminal using Microscan's K command format. Refer to the **Read Cycle** section of **Appendix E**.

Read Cycle Setup

Setting up read cycle and triggering parameters involves a series of decisions based on the particular application, as follows:

1. Select the number of symbols to be read in a single cycle.
2. Decide on the trigger type to be used: if serial, choose a serial character; if external, choose either **External Level** or **External Edge**.
3. Designate how the read cycle should end (**Timeout**, **New Trigger**).

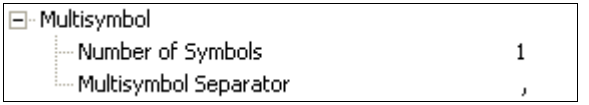
Multisymbol

Multisymbol is commonly used in shipping applications where a shipping symbol contains individual symbols for part number, quantity, etc. This feature allows one trigger to pick up all the symbols.

Multisymbol allows the user to define up to 100 symbols that can be read in a single read cycle.

The following conditions apply:

- Each symbol must be different to be decoded.
- The maximum number of characters in a read cycle is 3,000 for all symbols.
- All No Read messages are posted at the end of the data string, unless output filtering is enabled.
- If more than one symbol is within the field of view at the same time, symbol data may not be displayed in the order of appearance.
- If **Matchcode Type** is set to **Sequential** or if **Trigger** is set to **Continuous Read 1 Output**, the imager will behave as if **Number of Symbols** were set to **1**, regardless of the user-defined configuration.



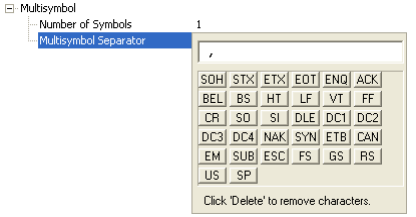
Number of Symbols

Number of Symbols is the number of different symbols that can be read in a single read cycle.

Multisymbol Separator

Multisymbol Separator is used to delimit or separate data fields with a user-defined character.

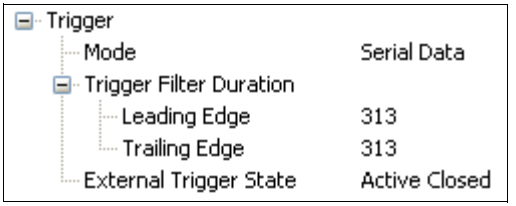
The Multisymbol Separator can be any valid ASCII character, inserted between each symbol read when Number of Symbols is set to any number greater than **1**.



Trigger

The **Trigger** is the event that initiates a read cycle.

Note: When calibrating the imager or testing read rate, the current trigger setting will be disregarded.



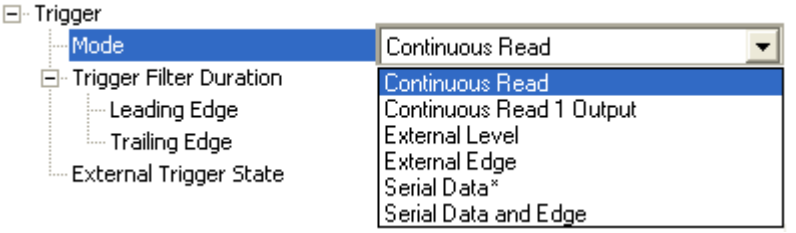
Trigger Mode

Continuous Read

Continuous Read is useful in testing symbol readability or imager functions. It is not recommended for normal operations.

In Continuous Read, trigger input options are disabled, the imager is always in the read cycle, and it will attempt to decode and transmit data for every symbol. If a single symbol stays within read range for multiple read cycles, its data will be transmitted repeatedly until it leaves the read range.

The imager sends replies to serial commands that require responses when symbol data is transmitted, or read cycle timeout is enabled and a timeout occurs. Depending on the combination of enabled symbologies and the Threshold Mode setting, the imager may take longer than the timeout to process symbol data.



Note: When to Output and **No Read** options have no affect on **Continuous Read**.

Continuous Read 1 Output

Continuous Read 1 Output can be useful in applications where it is not feasible to use a trigger and all succeeding symbols contain different information. It is also effective in applications where the objects are presented by hand.

In **Continuous Read 1 Output** the imager self-triggers whenever it decodes a new symbol or a timeout occurs.

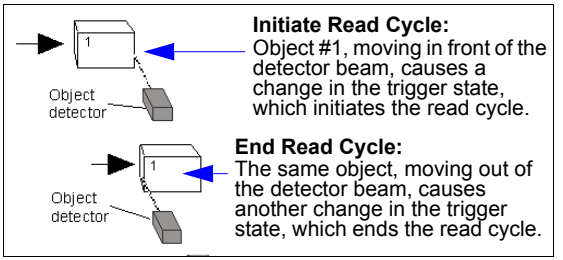
If **End of Read Cycle Mode** is set to **Timeout** and the symbol doesn't change, the output is repeated at the end of each timeout period. For example, if **Timeout** is set to one second, the imager sends the symbol data immediately and repeats the output at intervals of one second for as long as the symbol remains in the field of view.

If **End of Read Cycle Mode** is set to **New Trigger**, the imager will send the current symbol data immediately, *but only once*. A new symbol appearing in the imager's range will be read and sent immediately, provided it is not identical to the previous symbol.

Caution: In automated environments, **Continuous Read 1 Output** is not recommended because there is typically no reliable way to verify that a symbol was missed.

Note: If **Trigger Mode** is set to **Continuous Read 1 Output**, the imager will behave as if **Number of Symbols** were set to **1**, regardless of the user-defined configuration.

External Level

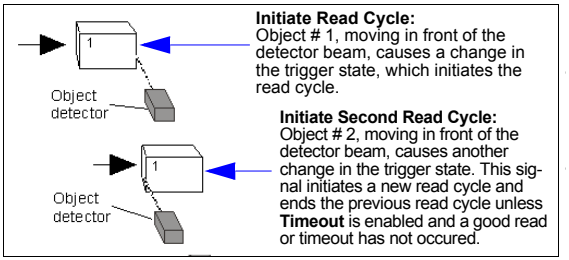


This mode is effective in an application where the speeds of the conveying apparatus are variable and the time the imager spends reading each object is not predictable. It also allows the user to determine if a No Read has occurred.

External Level allows the read cycle (active state) to begin when a trigger (change of state) from an external sensing device is received. The read cycle persists until the object moves out of the sensor range and the active trigger state changes again.

Important: Level and **Edge** apply to the active logic state (**Negative** or **Positive**) that exists while the object is in a read cycle, between the rising edge and the falling edge. *Rising edge* is the trigger signal associated with the appearance of an object. *Falling edge* is the trigger signal associated with the subsequent disappearance of the object. This applies both to **External Level** and **External Edge**.

External Edge



This mode is highly recommended in any application where conveying speed is constant, or if spacing, object size, or read cycle timeouts are consistent.

External Edge, as with Level, allows the read cycle (active state) to begin when a trigger (change of state) from an external sensing device is received. However, the passing of an object out of sensor range does not end the read cycle. The read cycle ends with a good read output, or, depending on the **End of Read Cycle Mode** setting, a timeout or new trigger occurs.

Serial Data

Serial Data is effective in a highly controlled environment where the host knows precisely when the object is in the field of view. It is also useful in determining if a No Read has occurred.

In **Serial Data**, the imager accepts an ASCII character from the host or controlling device as a trigger to start a read cycle. A **Serial Data** trigger behaves the same as an **External Edge** trigger.

Serial commands are entered inside angle brackets, as shown here: **<*n*>**.

Note: In **Serial Data**, sending a non-delimited start serial character will start a read cycle; however, a non-delimited stop serial character has no effect.

Serial Data and Edge

Serial Data and Edge is seldom used but can be useful in an application that primarily uses an external sensing device but occasionally needs to be triggered manually.

An auxiliary terminal can be connected to the auxiliary port so the user can send the serial trigger character through the imager to the host.

In this mode the imager accepts either a serial ASCII character or an external trigger pulse to start the read cycle.

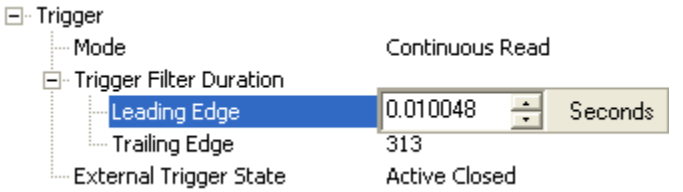
Note: In **Serial Data**, sending a non-delimited start serial character will start a read cycle; however, a non-delimited stop serial character has no effect.

Trigger Filter Duration

Leading Edge

Used to ignore accidental triggers when **Trigger Mode** is set to **External Edge** or **External Level**.

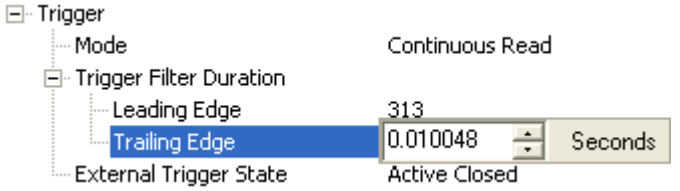
To consider a change in state on the trigger input, the level must be stable for the trigger filter duration. In an edge mode, the imager will trigger a read cycle if the active state has been uninterrupted for the entire trigger filter duration. In a level mode, the leading edge is filtered such that on an active edge, the state must be held interrupted for the trigger filter duration before a trigger will occur.



Trailing Edge

Used to ignore accidental triggers when **Trigger Mode** is set to **External Edge** or **External Level**.

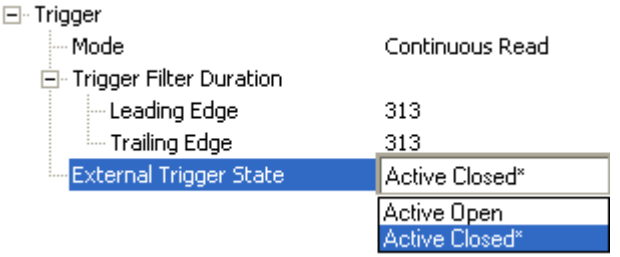
To consider a change in state on the trigger input, the level must be stable for the trigger filter duration. In an edge mode, the imager will trigger a read cycle if the active state has been uninterrupted for the entire trigger filter duration. In a level mode, the trailing edge is filtered such that on the falling edge, the state must be held for the trigger filter duration before the trigger will be deemed inactive.



External Trigger State

Allows users to select the trigger polarity that will be used in their application.

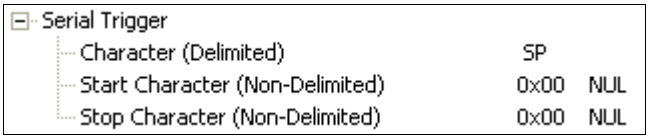
Determines the active state of the trigger signal applied to the cable input of the imager.



Serial Trigger

Allows the user to define the trigger character and delimiters that start and stop the read cycle.

A serial trigger is considered an online host command and requires the same command format as all host commands. It must be entered within angle bracket delimiters **<** and **>** or, in the case of non-delimited triggers, it must define individual start and stop characters.

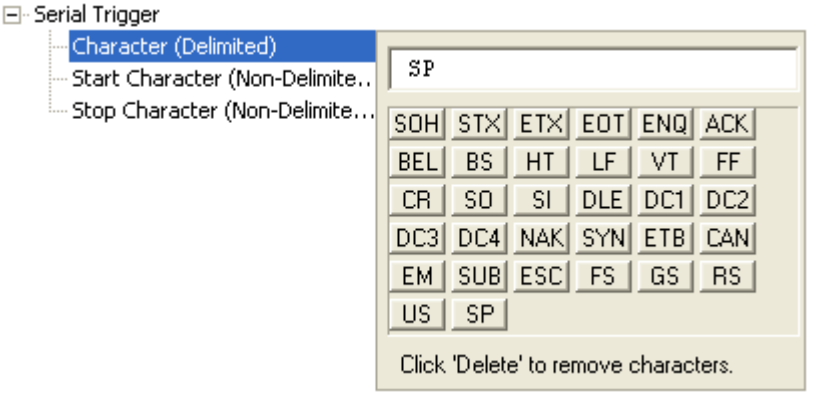


Character (Delimited)

Allows the user to define the trigger character that initiates the read cycle.

A single ASCII host serial trigger character that initiates the read cycle.

A delimited trigger character is one that either starts or ends the read cycle and is enclosed by delimiters such as **<** and **>**.



Note: Serial Data or **Serial Data and Edge** trigger mode must be enabled for **Serial Trigger Character** to function.

Start Character (Non-Delimited)

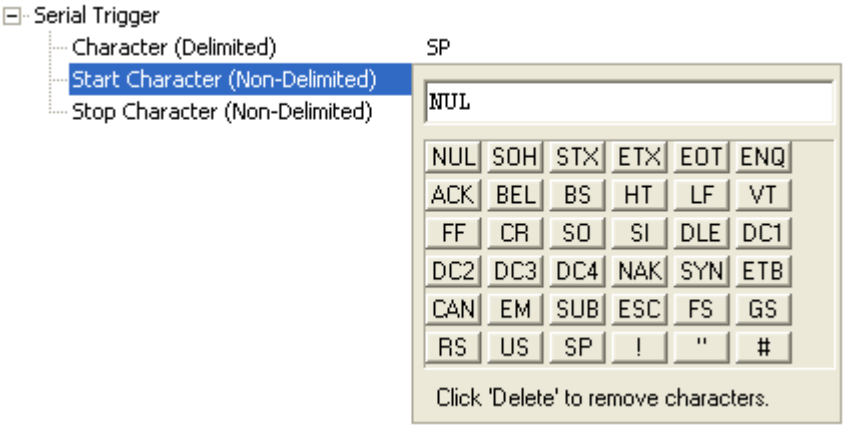
Useful in applications where different characters are required to start a read cycle.

A single ASCII host serial trigger character that starts the read cycle and is not enclosed by delimiters such as **<** and **>**.

Non-delimited **Start** characters can be defined and will function according to the trigger event.

When defining **Start** trigger characters, the following rules apply:

- In **External Edge** the imager looks only for the **Start** trigger character and ignores any **Stop** trigger character that may be defined.
- In **External Level** the **Start** trigger character begins the read cycle and the **Stop** trigger character ends it. Note that even after a symbol has been decoded and the symbol data transmitted, the imager remains in **External Level** trigger read cycle until a **Stop** character is received.
- In **Serial Data and Edge** trigger mode, either a **Start** trigger character or a hardware trigger can start an edge trigger read cycle.



Stop Character (Non-Delimited)

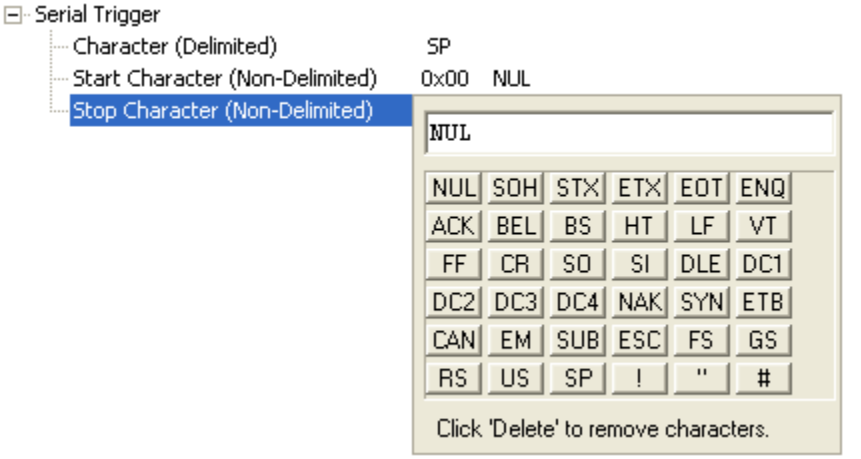
Useful in applications where different characters are required to end a read cycle.

A single ASCII host serial trigger character that ends the read cycle and is not enclosed by delimiters such as **<** and **>**.

Non-delimited **Stop** characters can be defined and will function according to the trigger event.

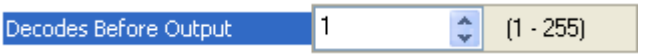
When defining **Stop** trigger characters, the following rules apply:

- In **External Edge** the imager looks only for the **Start** trigger character and ignores any **Stop** trigger character that may be defined.
- In **External Level** the **Start** trigger character begins the read cycle and the **Stop** trigger character ends it. Note that even after a symbol has been decoded and the symbol data transmitted, the imager remains in **External Level** trigger read cycle until a **Stop** character is received.
- In **Serial Data and Edge** trigger mode, either a **Start** trigger character or a hardware trigger can start an edge trigger read cycle.



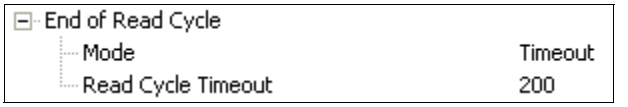
Decodes Before Output

Decodes Before Output specifies the number of times a symbol needs to be decoded before symbol data is output and a good read is declared.



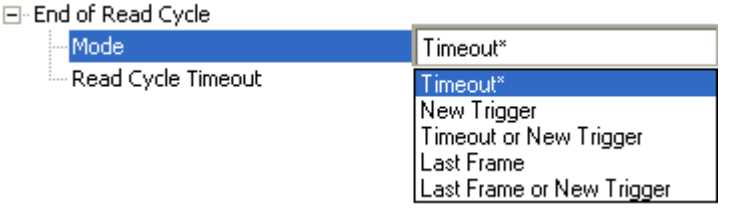
End of Read Cycle

The read cycle is the time during which the imager will attempt to decode a symbol. A read cycle can be ended by a timeout or a new trigger, or a combination of the two.



End of Read Cycle Mode

Note: When operating in **Continuous Read** or **Continuous Read 1 Output**, the imager is always in the read cycle.



Timeout

Typically used with **Continuous Read 1 Output** and **Serial Data and Edge**.

It is effective in highly controlled applications when the maximum length of time between objects can be predicted. It assures that a read cycle ends before the next symbol appears, giving the system extra time to decode and transmit the data to the host.

Timeout ends the read cycle, causing the imager to stop reading symbols and send the symbol data or No Read message when the time set in **Timeout** elapses (times out), if **When to Output Symbol Data** is set to **End of Read Cycle**.

If in **Continuous Read 1 Output**, a timeout initiates a new read cycle and allows the same symbol to be read again.

With **External Edge**, **Serial Data**, or **Serial Data and Edge** enabled, a timeout ends the read cycle and symbol data or a No Read message is sent to the host.

With **External Level** enabled, the read cycle does not end until the falling edge trigger occurs or a timeout occurs. The next read cycle does not begin until the next rising edge trigger.

New Trigger

New Trigger is an effective way to end a read cycle when objects move past the imager at irregular intervals (not timing-dependent).

New Trigger ends the current read cycle and initiates a new one when a new trigger occurs. **New Trigger** refers only to a rising edge trigger.

With **External Edge**, **Serial Data**, or **Serial Data and Edge** enabled, an edge or serial trigger ends a read cycle and initiates the next read cycle.

In the case of **External Level**, a falling edge trigger ends the read cycle but the next read cycle does not begin until the occurrence of the next rising edge trigger.

Timeout or New Trigger

Useful in applications that require an alternative way to end the read cycle. For example, if an assembly line should stop completely or the intervals between objects are highly irregular.

Timeout or New Trigger is identical to **Timeout** except that a timeout *or* a new trigger (whichever occurs first) ends the read cycle.

Last Frame

Useful in applications in which the timeout duration varies.

Last Frame or New Trigger

Useful in applications in which line speeds are irregular and a new object could appear before the last frame in the sequence.

Last Frame or New Trigger is identical to **New Trigger** except that a new trigger *or* last frame (whichever occurs first) ends the read cycle.

Read Cycle Timeout

Read Cycle Timeout determines the duration of the read cycle.

Capture Mode

Capture mode specifies how multiple captures are taken and managed throughout a read cycle.

Rapid Capture

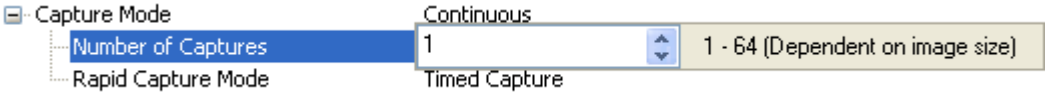
In a rapid capture mode one or multiple captures can taken at an interval specified by the time delay between captures parameter. In this mode the only limiting time factor is the integration and transfer timing.

Continuous Capture

In continuous capture mode captures are continually taken throughout the read cycle in a multi-buffered format so that we start processing the first image while we are capturing the second. Continuous capture mode will override the pre-processing field; this improves performance in the multi-buffered format. This mode operation as laser scanners have historically operated, with captures spanning the entire read cycle duration until an exit condition occurs such as qualification or timeout.

Number of Captures

Specifies the number of captures to process in the rapid capture mode. This parameter is used in conjunction with the time delay between captures parameters to specify the capture sequence of a rapid capture read cycle.



Rapid Capture Mode

Timed Capture

Capture events are controlled by the timing values entered in the “Capture Time” command.

Triggered Capture

When set to trigger captures mode the imager operates in the following manner:

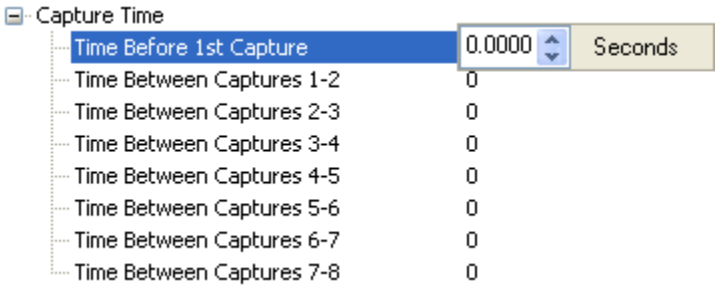
- The number of captures represents the number of triggers expected from the system per read cycle. The first trigger enters the read cycle.
- Subsequent triggers initiate captures in the read cycle up to the number of captures is met or the end of read cycle condition is met. Any additional triggers between reaching the number of captures and meeting the end of read cycle requirements will be ignored.
- If the read cycle is fully qualified prior to reaching the number of captures and the symbol output is set to ASAP, the symbol data will be output and all post processing (Logic outputs, video, etc.) will finish but the imager will remain in the read cycle. When enough triggers come in to satisfy the number of captures setting or a timeout expires, the imager will exit the read cycle. This operation would be synonymous with level triggered read cycle waiting for the trigger to fall.
- If the end of read cycle is set for new trigger and the read cycle qualifications have not been met, the read cycle will exit upon receiving the first trigger after reaching the number of captures setting. At this time the post processing from the read cycle will complete and a new read cycle will begin.

Capture Time

This command specifies the frame delays associated with the frames captured in a rapid capture mode of operation.

Time Before 1st Capture

This value specifies the delay from the trigger to the first capture of any triggered read cycle.



Time Between Captures 1-2

This value specifies the delay to wait before starting a frame capture for the next capture in the rapid capture sequence.

Time Between Captures 2-3

This value specifies the delay to wait before starting a frame capture for the next capture in the rapid capture sequence.

Time Between Captures 3-4

This value specifies the delay to wait before starting a frame capture for the next capture in the rapid capture sequence.

Time Between Captures 4-5

This value specifies the delay to wait before starting a frame capture for the next capture in the rapid capture sequence.

Time Between Captures 5-6

This value specifies the delay to wait before starting a frame capture for the next capture in the rapid capture sequence.

Time Between Captures 6-7

This value specifies the delay to wait before starting a frame capture for the next capture in the rapid capture sequence.

Time Between Captures 7-8

This value specifies the delay to wait before starting a frame capture for the next capture in the rapid capture sequence.

Notes for Rapid Capture, Timed Capture

If rapid capture is configured for timed captures this delay is measured from the point at which the previous delay expired. If the delay expires during a previous capture the start of the capture will occur as soon as the previous capture or captures complete. For example, if rapid capture is configured for 8 captures and all delays are configured for zero all 8 captures will occur back to back as fast as the imager is able.

Notes for Rapid Capture, Triggered Capture

If rapid capture is configured for triggered captures mode the delay taken is measured from the point at which the trigger for that capture is received. Also if an incoming trigger occurs before a previous delay has expired, the previous capture is initiated and the delay for the incoming trigger is started.

Important: If the unit is triggered to capture more than 8 images the unit will repeat the last delay (8th) for the remaining frames.

Store No Read Image

Image storage allows the user to store images from separate read cycles and has the ability to retrieve them later. The number of available slots for storage depends on the mode of operation. If functioning in the rapid capture mode the number of images available to store is the maximum number of the rapid count – the current setting for rapid count. If the user is operating in a continuous capture mode then they can store up to the maximum number of the rapid count – 3.

Image Storage Type

Disabled / Clear

Upon selection, all saved images will be cleared, and the unit will not store images for later retrieving.

Store on No Read

The unit will store an image upon exiting the read cycle that retrieved a later time. If multiple captures are present during the duration of a read cycle the image stored will be the last image processed for the read cycle. This image is stored in RAM and can be retrieved as long as power is applied and the unit has not been reset via reset/save sequences. Other commands that can initialize the storage RAM are ones that changed capture modes or put the unit in a test capture mode.

Image Storage Mode

First Image

In this mode the image storage will store images until the available image memory has been filled. At this point the unit will stop saving additional images. In this mode you will always have the first images that were stored.

Last Image

In this mode the image storage will continue to store images after the available memory has been filled by purging the oldest image in the storage memory. In this mode you will always have the last images that were stored.

Image Processing Settings

Number of Symbols in Field of View

Any Number of Symbols

No limit on number of symbols attempted to decode in an image frame.

One Symbol

Only one symbol will be decoded in an image frame, and this will be regardless of any qualifying attributes associated with the read cycle.

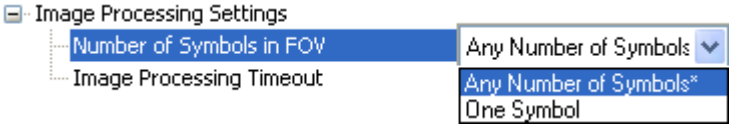


Image Processing Timeout

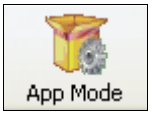
Specifies the maximum amount of time allowed for image processing to spend on a captured image. When the time-out expires, the image processing is aborted. This time-out works in both rapid capture and continuous capture modes, as well as with the configuration database.

Notes:

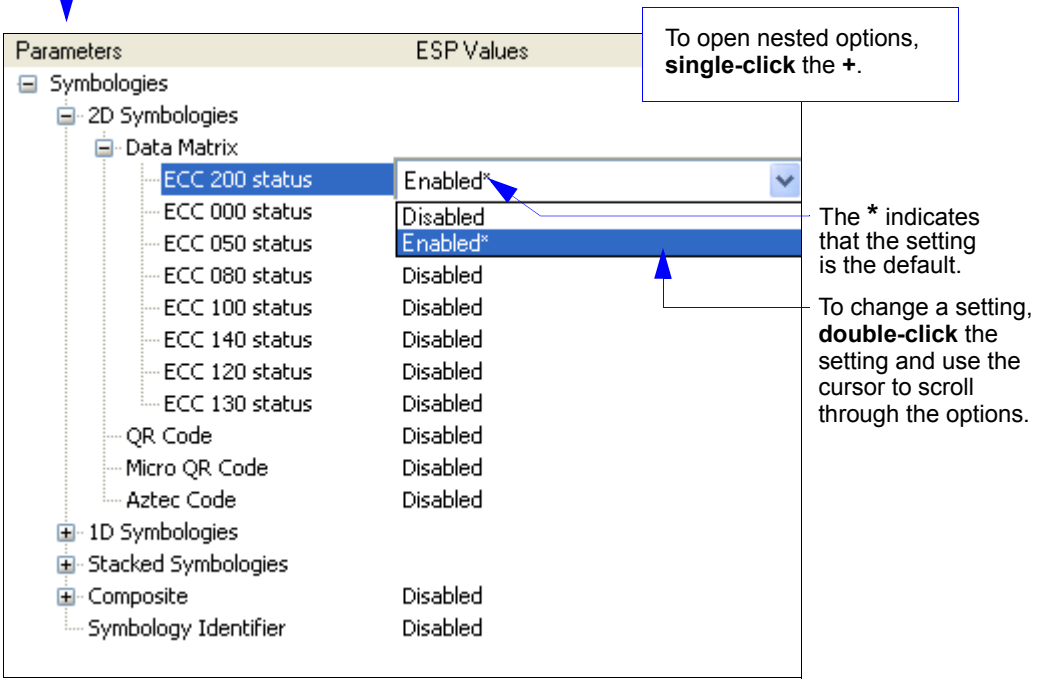
The time-out period does not include capture time.

If a time-out occurs the image will be recorded as a No Read. This may cause some confusion because the image may decode fine given enough time.

Symbologies

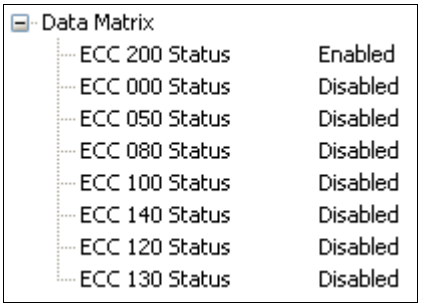


Click the **App Mode** button and then the **Parameters** button to display the tree control tabs.
Then click the **Symbologies** tab to display the Symbologies tree control.



Note: Symbologies settings can also be sent to the imager from ESP's Terminal using Microscan's K command format. Refer to the **Symbologies** section of **Appendix E**.

Data Matrix



ECC 200 Status

Disabled

The imager will not attempt to decode ECC 200 symbols.

Enabled

The imager will attempt to decode ECC 200 symbols.

ECC 000 Status

Disabled

The imager will not attempt to decode ECC 000 symbols.

Enabled

The imager will attempt to decode ECC 000 symbols.

ECC 050 Status

Disabled

The imager will not attempt to decode ECC 050 symbols.

Enabled

The imager will attempt to decode ECC 050 symbols.

ECC 080 Status

Disabled

The imager will not attempt to decode ECC 080 symbols.

Enabled

The imager will attempt to decode ECC 080 symbols.

ECC 100 Status

Disabled

The imager will not attempt to decode ECC 100 symbols.

Enabled

The imager will attempt to decode ECC 100 symbols.

ECC 140 Status

Disabled

The imager will not attempt to decode ECC 140 symbols.

Enabled

The imager will attempt to decode ECC 140 symbols.

ECC 120 Status

Disabled

The imager will not attempt to decode ECC 120 symbols.

Enabled

The imager will attempt to decode ECC 120 symbols.

ECC 130 Status

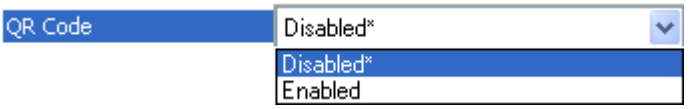
Disabled

The imager will not attempt to decode ECC 130 symbols.

Enabled

The imager will attempt to decode ECC 130 symbols.

QR Code



Disabled

The imager will not attempt to decode QR Code symbols.

Enabled

The imager will attempt to decode QR Code symbols.

Micro QR Code

Disabled

The imager will not attempt to decode Micro QR Code symbols.

Enabled

The imager will attempt to decode Micro QR Code symbols.

Code 39

Code 39 is considered the standard for non-retail 1D symbology.

An alphanumeric symbology with unique start/stop code patterns, composed of 9 black and white elements per character, of which 3 are wide.

Code 39	Enabled
Check Character Status	Disabled
Check Character Output Status	Disabled
Large Intercharacter Gap	Disabled
Fixed Symbol Length Status	Disabled
Fixed Symbol Length	10
Full ASCII Set	Disabled

Check Character Status

Enables or Disables the check character.

Check Character Output Status

Check Character Output Status, when added to the symbol, provides additional data security.

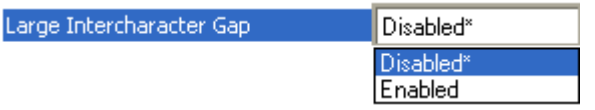
When enabled, the check character character is read and compared along with the symbol data. When disabled, symbol data is sent without the check character.

Note: With **Check Character Output Status** enabled and an **External Edge**, **External Level**, or **Serial Data** trigger option enabled, an invalid check character calculation will cause a **No Read Message** to be transmitted at the end of the read cycle.

Large Intercharacter Gap

Large Intercharacter Gap is helpful for reading symbols that are printed out of specification.

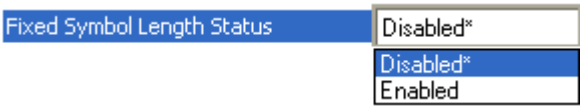
When enabled, the imager can read symbols with gaps between symbol characters that exceed three times (3x) the narrow element width.



Important: Do not use **Large Intercharacter Gap** with **Narrow** or **Narrow, Enhanced** Quiet Zone enabled, because a large intercharacter gap (over 3x) could cause a narrow quiet zone (5x) to be interpreted as an intercharacter gap.

Fixed Symbol Length Status

When enabled, the imager will check the symbol length against the symbol length field. If disabled, any length will be considered valid.



Fixed Symbol Length

Fixed Symbol Length helps prevent truncations and increases data integrity by ensuring that only one symbol length will be accepted.

Specifies the exact number of characters that the imager will recognize (this does not include start and stop and check character characters). The imager ignores any symbology that does not match the specified length.

Full ASCII Set

Must be enabled when reading characters outside the standard character set (0-9, A-Z, etc.)

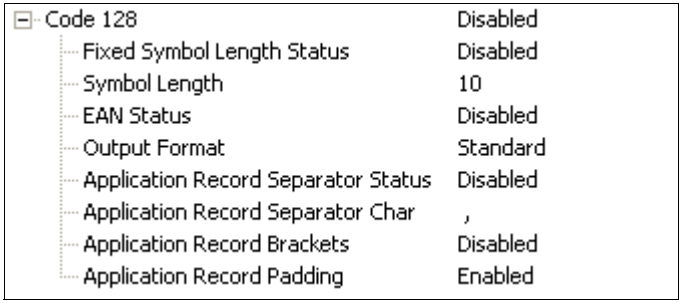
The user must know in advance whether or not to use the **Full ASCII Set** option. Since **Full ASCII Set** requires two code words to encode one character, it is less efficient.

Standard Code 39 encodes 43 characters; zero through nine, capital “A” through capital “Z”, minus symbol, plus symbol, forward slash, space, decimal point, dollar sign, and percent symbol. When **Full ASCII Set** is enabled, the imager can read the full ASCII character set, from 0 to 255.

Code 128

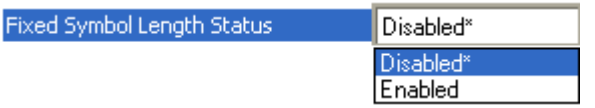
Code 128 is a smaller symbology useful in applications with limited space and high-security requirements.

A very dense alphanumeric symbology. It encodes all 128 ASCII characters, it is continuous, has variable length, and uses multiple element widths measured edge to edge.



Fixed Symbol Length Status

When enabled, the imager will check the symbol length against the symbol length field. If disabled, any length will be considered a valid symbol.



Symbol Length

Symbol Length helps prevent truncations and increases data integrity by ensuring that only one symbol length will be accepted.

This specifies the exact number of characters that the imager will recognize (this does not include start, stop, and check character characters). The imager ignores any symbol not having the specified length.

EAN Status

When this field is disabled, the imager will not check any Code 128 labels for conformance to EAN requirements, or perform any special formatting.

When enabled, the imager can read symbols with or without a function 1 character in the first position. If a symbol has a function 1 character in the first position, it must conform to EAN format. Symbols that conform to EAN format will also be subject to the special output formatting options available in this command.

If EAN status is required, the imager will only decode symbols that have a function 1 character in the first position and that conform to EAN format. All symbols read will be subject to the special output formatting options available in this command.

Note: Code 128 status must be enabled for EAN status to be active.

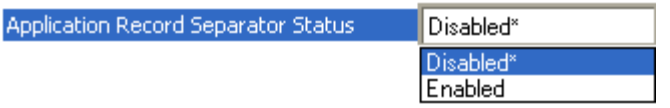
Output Format

In **Standard**, the imager will not apply special EAN output formatting options.

In **Application**, the imager will apply the special EAN output formatting options to decoded EAN-conforming symbols.

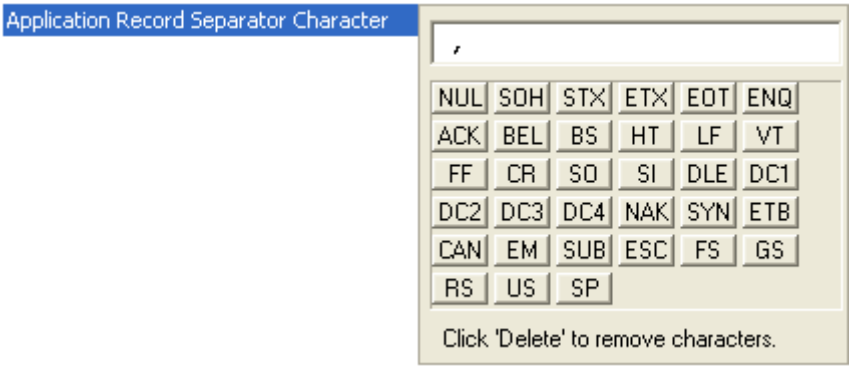
Application Record Separator Status

When enabled, an EAN separator will be inserted into the output between fields whenever an EAN-conforming symbol is decoded and EAN output formatting applies.



Application Record Separator Character

This is an ASCII character that serves as an EAN separator in formatted EAN output.



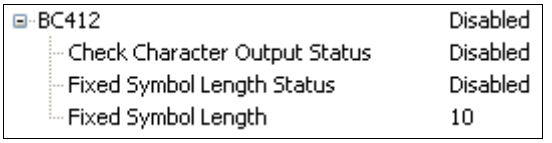
Application Record Brackets

If an EAN-conforming symbol is decoded and EAN formatting applies, this feature places bracket characters around the application identifiers in the formatted output.

Application Record Padding

This feature causes the imager to pad variable-length application fields with leading zeroes. This is not done for the last field of a symbol.

BC412



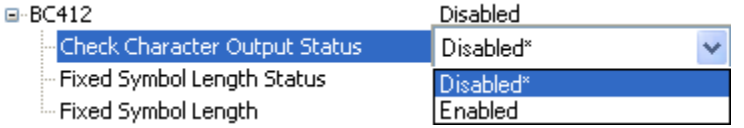
Check Character Output Status

Disabled

The imager will strip the verified check digit from the symbol data.

Enabled

The imager will format the verified check digit as part of the symbol data.



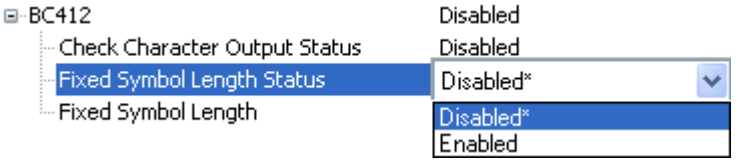
Fixed Symbol Length Status

Disabled

The imager will accept any length BC412 symbol as valid.

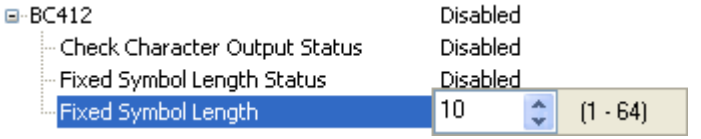
Enabled

The imager will reject any BC412 symbol that does not match the fixed code length value for BC412.



Fixed Symbol Length

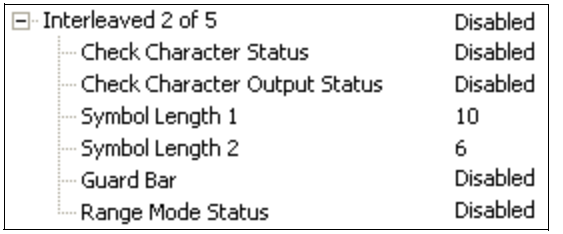
The code length used to validate BC-412 symbols if the fixed code length status is set to enabled.



Interleaved 2 of 5

Interleaved 2 of 5 has been popular because it is the most dense symbology for printing numeric characters less than 10 characters in length; however, Microscan does not recommend this symbology for any new applications because of inherent problems such as symbol truncation.

A dense, contimuous, self-checking, numeric symbology. Characters are paired together so that each character has five elements, two wide and three narrow, representing numbers 0 through 9, with the bars representing the first character and the interleaved spaces representing the second character. (A check character is highly recommended).



Check Character Status

This option is not typically used, but it can be enabled for additional security in applications where the host requires redundant check character verification.

An error correcting routine in which the check character character is added.

Check Character Output Status

When enabled, a check character character is sent along with the symbol data for added data security.

Symbol Length 1

Useful in applications where Interleaved 2 of 5 symbols of a specific length are required.

The **Symbol Length 1** field is one of two fields against which the decoded symbol is compared before accepting it as valid or rejecting it.

Important: If **Range Mode Status** is set to **Disabled**, the length of the symbol must match either **Symbol Length 1** *or* **Symbol Length 2** to be considered a valid symbol.

If **Range Mode Status** is set to Enabled, **Symbol Length 1** and **Symbol Length 2** form a range into which the length of the symbol must fall to be considered valid.

Symbol Length 2

Useful in applications where Interleaved 2 of 5 symbols of a specific length are required.

The **Symbol Length 2** field is one of two fields against which the decoded symbol is compared before accepting it as valid or rejecting it.

Important: If **Range Mode Status** is set to **Disabled**, the length of the symbol must match either **Symbol Length 2** *or* **Symbol Length 1** to be considered a valid symbol.

If **Range Mode Status** is set to Enabled, **Symbol Length 2** and **Symbol Length 1** form a range into which the length of the symbol must fall to be considered valid.

Guard Bar

Note: Whenever **Guard Bar** is enabled, the presence of guard bars is required for decoding to take place.

Useful when Interleaved 2 of 5 multisymbols are enabled to prevent false data output. This typically occurs with highly tilted or skewed symbols.

A guard bar is a heavy bar, at least twice the width of the wide bar, surrounding the printed Interleaved 2 of 5 symbol and helping to prevent false reads.

Range Mode Status

Important: Unless **Range Mode** is enabled, **Symbol Length** must be set to decode Interleaved 2 of 5 symbols.

Useful in applications where Interleaved 2 of 5 symbols of a specific length are required.

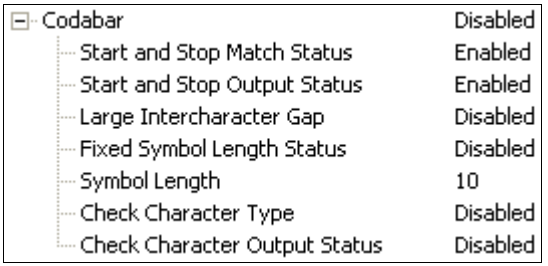
When **Range Mode** is disabled, the imager checks the value of the symbol length against the values set in **Symbol Length 1** and **Symbol Length 2**. If the symbol length does not match either of the preset values, then it is rejected as invalid.

When **Range Mode** is enabled, **Symbol Length 1** and **Symbol Length 2** are combined to form a range of valid symbol lengths. Any symbol length that does not fall into this range is rejected as an invalid symbol. Either of the preset symbol length values in the **Symbol Length 1** and **Symbol Length 2** fields can form the start or end of the range.

Codabar

Used in photo-finishing and library applications. Previously used in medical applications, but not typically used in newer medical applications.

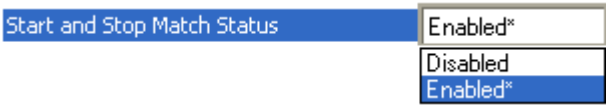
Codabar is a 16-bit character set (0 through 9, and the characters **$**, **:**, */*, **.**, **+**, and **–**) with start/stop codes and at least two distinctly different bar widths.



Start and Stop Match Status

When disabled, the imager will decode Codabar symbols whether or not the start and stop characters are the same.

When enabled, the imager will not decode Codabar symbols unless the start and stop characters are the same.

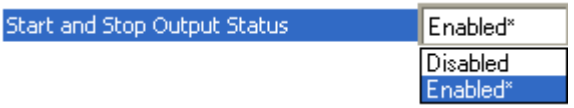


Start and Stop Output Status

When disabled, the start and stop characters will *not* be present in the data output of the decoded symbol.

When enabled, the start and stop characters *will* be present in the data output of the decoded symbol.

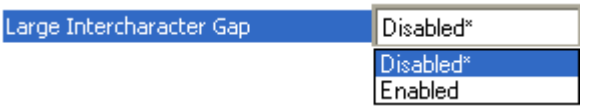
Note: Because the start and stop characters are included as part of the data, the characters must be included as part of the length in a fixed length mode of operation.



Large Intercharacter Gap

When disabled, the spaces between characters, or the “intercharacter gap”, are ignored during the decode process.

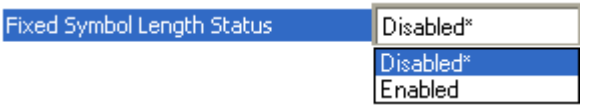
Note: If the intercharacter space is large enough to be considered a margin, the symbol will not decode, regardless of this parameter’s setting.



Fixed Symbol Length Status

When disabled, the imager will accept any Codabar symbol provided it doesn’t exceed the system’s maximum capabilities.

When enabled, the imager will reject any Codabar symbol that doesn’t match the fixed length.



Symbol Length

This is the value against which all Codabar symbol lengths will be compared.

Check Character Type

When disabled, the imager will not perform any character checking calculations on decoded Codabar symbols.

When set to **Mod 16**, the imager will perform a modulus 16 check character calculation on the symbol. If the symbol does not pass this calculation, it will not be decoded.

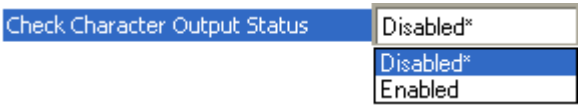
When set to **NW 7**, the imager will perform an NW7 modulus 11 check character calculation on the symbol. If the symbol does not pass this calculation, it will not be decoded.

When set to **Both**, the imager will perform both the Mod 16 and NW7 modulus 11 check character calculations on the symbol. If the symbol does not pass either calculation, it will not be decoded.

Check Character Output Status

When this field is disabled and a check character calculation is enabled, the imager will strip the verified check character from the symbol data output. This condition must be accounted for if a fixed length is also being used.

When enabled, the imager will output the check character as part of the symbol data. This condition must be accounted for if a fixed length is also being used.

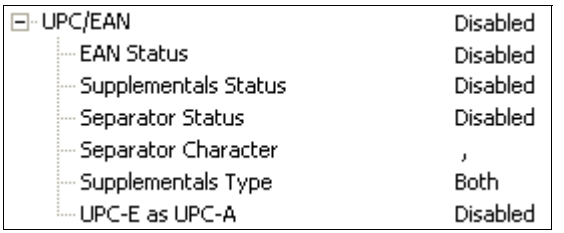


UPC/EAN

Used primarily in point-of-sale applications in the retail industry. It is commonly used with Microscan imagers in applications in combination with **Matchcode** when there is a need to verify that the right product is being placed in the right packaging.

UPC (Universal Product Code) is a fixed length, numeric, continuous symbology. UPC can have two- or five-digit supplemental data following the normal symbol. The UPC Version A (UPC, A) symbol is used to encode a 12 digit number. The first digit is the number system character, the next five are the manufacturer number, the next five are the product number, and the last digit is the checksum character.

When enabled, the imager will read UPC Version A and UPC Version E only.



EAN Status

EAN is the European version of the UPC symbology and is used in European retail applications.

Note: UPC must be enabled for **EAN** to take effect.

EAN is a subset of UPC. When enabled, the imager will read UPC Version A, UPC Version E, EAN 13, and EAN 8. It also appends a leading zero to UPC Version A symbol information and transmits 13 digits. If transmitting 13 digits when reading UPC Version A symbols is not desired, disable EAN.

Note: The extra character identifies the country of origin.

Supplementals Status

Reads **Supplementals** typically used in publications and documentation.

A supplemental is a 2 to 5 digit symbol appended to the main symbol. When set to **Enabled** or **Required**, the imager reads supplemental code data that has been appended to the standard UPC or EAN codes.

Disabled

UPC **Supplementals** will not be decoded.

Enabled

When enabled, the imager will try to decode a main and a supplemental. However, if a supplemental is not decoded, the main will be sent by itself at the end of the read cycle.

Required

When set to **Required**, both the main and the supplemental symbols must be read or a single No Read condition results.

For example, if **Supplementals** is set to **Required**, **Separator** is enabled, and an asterisk is defined as the UPC separator character. Then the data is displayed as:

MAIN * SUPPLEMENTAL.

Note: Under no circumstances will the supplemental symbol data be sent without a main symbol.

Note: If additional symbols—other than the main or supplemental—will be read in the same read cycle, **Number of Symbols** should be set accordingly.

Separator Status

Allows users to distinguish between the main and **Supplemental** symbols.

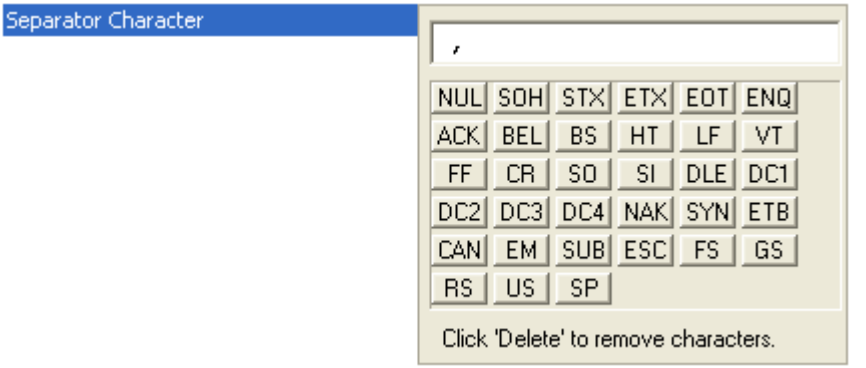
A character can be inserted between the standard UPC or EAN symbology and the supplemental symbology when **Supplementals** is set to **Enabled** or **Required**.

Separator Character

As required by the application.

Allows the user to change the separator character from a comma to a new character.

Note: Whenever **Separator Character** is defined as a comma (**,**) sending a **<K473,s?>** command from ESP's Terminal will return the current settings, including the separator character comma which appears after the separator status comma.



Supplementals Type

As required by symbology used in application.

Allows the user to select 2 character or 5 character supplements, or both.

Both

Either 2 character or 5 character supplementals will be considered valid.

Two Digits

Only two character supplementals will be considered valid.

Five Digits

Only five character supplementals will be considered valid.

UPC-E as UPC-A

When disabled, the imager will output the version E symbols in their encoded 6-character format.

When enabled, the imager will format the symbol as either a 12-character UPC-A symbol or an EAN-13 symbol, depending on the state of the EAN status parameter. This formatting reverses the zero suppression that is used to generate the symbol in the UPC specification.

Code 93

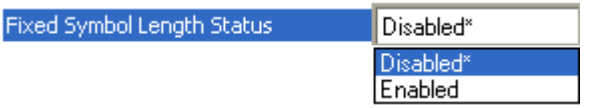
Used in some clinical applications.

Code 93 is a variable-length, continuous symbology employing four element widths. Each Code 93 character has nine modules that may be either black or white. Each character contains three bars and three spaces.

Fixed Symbol Length Status

When disabled, the imager will accept any Code 93 symbol provided is doesn't exceed the system's maximum capabilities.

When enabled, the imager will reject any Code 93 symbol that doesn't match the fixed symbol length.



Fixed Symbol Length

This is the symbol length value against which all Code 93 symbols will be compared.

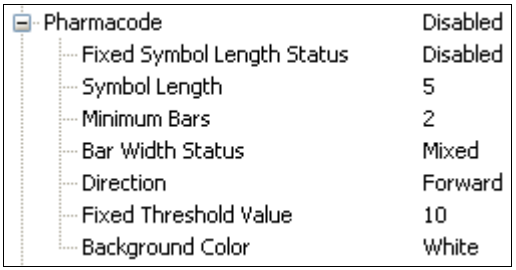
Pharmacode

Used mostly in pharmaceutical packaging.

Encodes up to five different numbers, each with its own color, which may be entered in decimal or “binary” format with a **1** represented by a thick bar and a **0** represented by a thin bar. Bar width is independent of height.

In decimal format, each part can be up to 999,999.

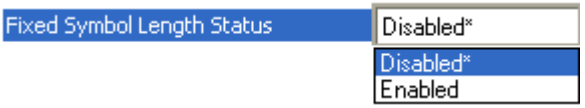
In binary format, each input can have up to 19 ones and zeros.



Important: When Pharmacode is enabled, other linear symbologies will not decode properly. Disable Pharmacode before reading other linear symbologies.

Fixed Symbol Length Status

When enabled, the imager will check the symbol length against the symbol length field. If disabled, any length will be considered valid.



Symbol Length

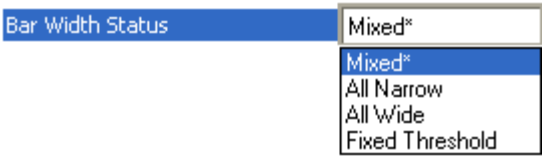
Specifies the exact number of bars that must be present for the imager to recognize and decode the Pharmacode symbol.

Minimum Bars

Sets the minimum number of bars that a Pharmacode symbol must have to be considered valid.

Bar Width Status

If set to **Mixed**, the imager will autodiscriminate between narrow bars and wide bars. If set to **All Narrow**, all bars will be considered as narrow bars. If set to **All Wide**, all bars will be considered as wide bars. If set to **Fixed Threshold**, it will use the fixed threshold value to determine whether the bars are narrow or wide. The **Bar Width Status** setting will be ignored when the imager is able to tell the difference between the narrow and the wide bars.



Direction

Specifies the direction in which a symbol can be read.

Fixed Threshold Value

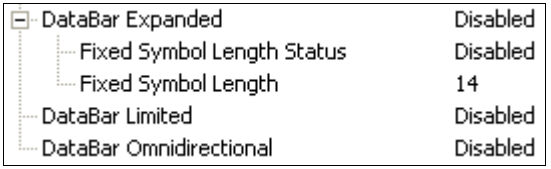
Used when **Bar Width Status** is set to **Fixed Threshold**. Defines the minimum difference in pixels that will distinguish a narrow bar from a wide bar.

Background Color

Specifies whether the symbol will be presented on a black background or a white background.

GS1 DataBar

Note: GS1 DataBar symbologies were previously known as “Reduced Space Symbology” or “RSS”.



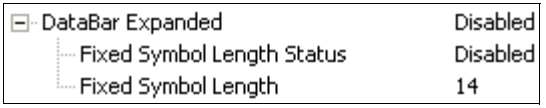
DataBar Expanded

Note: DataBar Expanded was previously known as “RSS Expanded”.

Used to encode primary and supplementary data in retail point-of-sale and other applications.

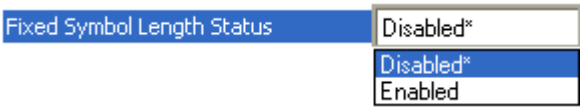
DataBar Expanded is a variable length symbology that can encode supplementary information in addition to the 14-digit EAN item identification number and is capable of encoding up to 74 numeric or 41 alphabetic characters.

Where appropriate, use 1 (non-stacked) for better performance over 2 (stacked and non-stacked).



Fixed Symbol Length Status

When enabled, the imager will check the symbol length against the symbol length field, minus the embedded check character. If disabled, any length would be considered valid.



Fixed Symbol Length

Fixed Symbol Length helps prevent truncations and increases data integrity by ensuring that only one symbol length will be accepted.

Specifies the exact number of characters that the imager will recognize (this does not include start, stop, and check character characters). The imager ignores any symbol not having the specified length.

DataBar Limited

Note: DataBar Limited was previously known as “RSS Limited”.

DataBar Limited is designed to be read by laser scanners and CCD imagers. It is not recommended for omnidirectional slot imagers.

Encodes a smaller 14-digit symbol (74 modules wide) that is not omnidirectional.

DataBar Omnidirectional

Note: DataBar Omnidirectional was previously known as “RSS-14”.

Used in the grocery, retail, and prescription drug industries where 14-digit EAN item identification may be needed.

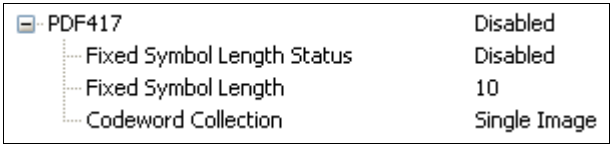
DataBar-14 is a fixed symbol length symbology that encodes 14 digits, including a 1-digit indicator. DataBar-14 is 96 modules wide. It can be stacked in two rows, it can read omnidirectionally if printed in full height, or horizontally if height-truncated for small marking.

Note: Where appropriate, use **1** (non-stacked) for better performance instead of **2** (stacked; decode both stacked and non-stacked).

PDF417

Used in applications where a large amount of information (over 32 characters) needs to be encoded within a symbol, typically where the symbol is transported from one facility to another. For example, an automobile assembly line might use a single symbol with multiple fields of information that will be read at several stations along the way, without reference to a database.

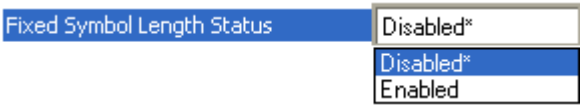
A two-dimensional, multi-row (3 to 90), continuous, variable-length symbology that has high data capacity (up to 2,700 numeric characters, 1,800 printable ASCII characters, or 1,100 binary characters per symbol). Each symbol character consists of 4 bars and 4 spaces in a 17-module structure.



Note: Sending **<a1>** from ESP's Terminal will cause PDF417 data to be prefaced with information consisting of error correction level (ECC Level ***n***), number of rows (***n*** Rows), number of columns (***n*** Columns), number of informative code words (***n*** Info Code Words) and the number of data characters (***n*** Data Characters). This feature can be disabled by re-sending **<a1>**.

Fixed Symbol Length Status

When Enabled, the imager will reject any PDF417 symbol that does not match the **Fixed Symbol Length**.



Fixed Symbol Length

Used to increase data integrity by ensuring that only one symbol length will be accepted.

When enabled, the PDF symbol must contain the same number of characters as the symbol length setting before it can be considered a good read. The imager will ignore any symbol not having the specified length.

Note: Fixed Symbol Length Status must be enabled for **Fixed Symbol Length** to take effect.

Codeword Collection

Single Image

The imager will attempt to decode the PDF417 symbol only from the information provided in a single image.

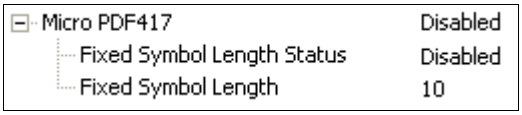
Multiple Image

The imager will process codewords from multiple images within the same read cycle and combine them to decode a single PDF417 symbol.

MicroPDF417

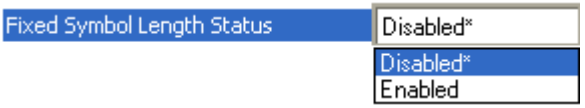
Used for labelling small items that need large data capacity.

A variant of PDF417, a very efficient and compact stacked symbology that can encode up to 250 alphanumeric characters or 366 numeric characters per symbol.



Fixed Symbol Length Status

When Enabled, the imager will reject any MicroPDF417 symbol that does not match the **Fixed Symbol Length**.



Fixed Symbol Length

Used to increase data integrity by ensuring that only one symbol length will be accepted.

When enabled, the MicroPDF417 symbol must contain the same number of characters as the symbol length setting before it can be considered a good read. The imager will ignore any symbol not having the specified length.

Note: Fixed Symbol Length Status must be enabled for **Fixed Symbol Length** to take effect.

Composite

When set to **Enabled** or **Required**, will decode the 2D composite component of a linear symbol. The linear symbol can be DataBar-14, DataBar Expanded, DataBar Limited, EAN-128, UPC-A, EAN-13, EAN-8, and UPC-E.

Enabled

If **Composite** is set to **Enabled**, the imager will decode both the 2D composite and linear components. However, if the 2D composite component is not decoded, the linear data will be sent by itself at the end of the read cycle.

Required

If set to **Required**, the imager must decode both components, or a No Read will occur.

Separator Status

Allows the user to distinguish between the main and **Supplemental** symbols.

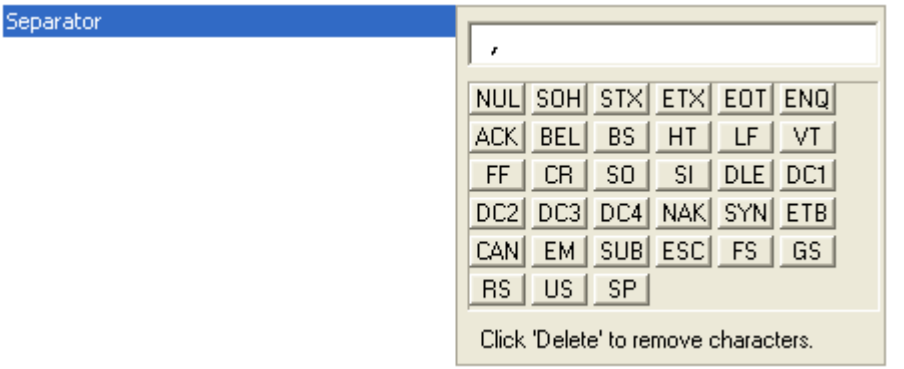
Separates the linear and the composite component.

Separator

The Separator Character will be the same as the character defined in the **Multisymbol Separator** field.

As required by the application.

Allows the user to change the separator character from a comma to a new character.



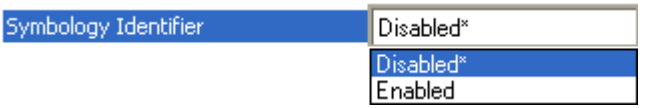
Symbology Identifier

Symbology Identifier is a standard prefix set of characters that identifies the symbol type.

When enabled, the imager analyzes and identifies the symbology and adds a three-character identifying prefix to the data:

- **]** (closed bracket character) indicating the presence of a symbology identifier.
- **A**, **C**, **E**, **F**, **G**, **I**, **L**, **e**, or **p**
- (A = Code 39; C = Code 128; E = UPC/EAN; F = Codabar; G = Code 93; I = Interleaved 2 of 5; L = PDF417 and MicroPDF417; e = GS1 DataBar (RSS); p = Pharmacode)
- Modifier

  Example: **]C** indicates a Code 128 symbol.



Disabled

When set to **Disabled**, symbol data output does not contain Symbology Identifier information.

Enabled

When set to **Enabled**, symbol data output contains a Symbology Identifier sequence.

Explanation of Modifiers for Code 39, Codabar, and Interleaved 2 of 5

- For Code 39, Codabar, and Interleaved 2 of 5, the modifier indicates **Check Character** and **Check Character Output** status.
- For Code 39 only, Full ASCII must be enabled to see modifiers **4**, **5**, and **7**.

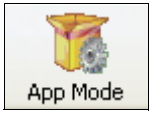
Modifier	*Check Character*	*Check Character Output*	*Full ASCII Conversion (Code 39 Only)*
0	Disabled	N/A	No
1	Enabled	Enabled	No
3	Enabled	Disabled	No
4	Disabled	N/A	Yes
5	Enabled	Enabled	Yes
7	Enabled	Disabled	Yes

Example: **]A5** indicates a **Code 39** symbol with **Check Character** and **Check Character Output** enabled and Full ASCII conversion performed.

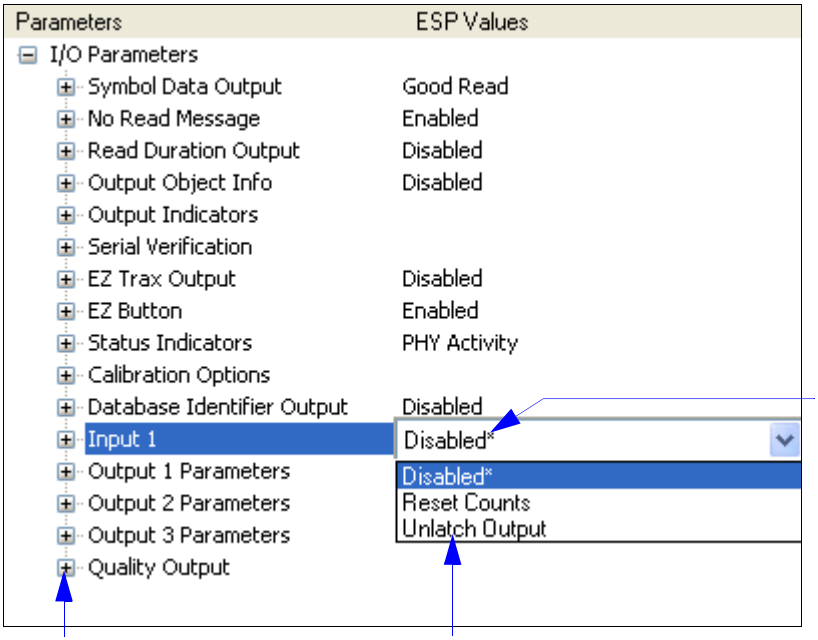
Explanation of Modifiers for Other Symbologies

- For Code 128, a **1** indicates EAN 128; otherwise the modifier is **0**.
- For all other symbologies, the modifier is **0**.

I/O Parameters



Click the **App Mode** button and then the **Parameters** button to display the tree control tabs.
Then click the **I/O** tab to display the I/O Parameters tree control.



The * indicates that the setting is the default.

To open nested options, **single-click** the **+**.

To change a setting, **double-click** the setting and use the cursor to scroll through the options.

Note: I/O Parameters settings can also be sent to the imager from ESP's Terminal using Microscan's K command format. Refer to the **I/O Parameters** section of **Appendix E**.

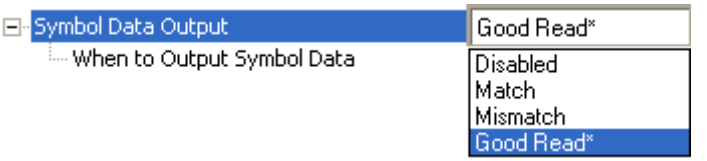
Symbol Data Output

Symbol Data Output relates to data and should not be confused with **Outputs 1**, **2**, and **3** listed in the **Output Parameters** which describe output states and functions.

Useful when the host needs symbol data only under certain conditions.

Defines the conditions under which decoded symbol data is transmitted to the host.

Note: Symbol Data Output Status, if set to **Match** or **Mismatch**, will not take effect unless **Matchcode Type** is enabled and a master symbol is loaded into memory.



Symbol Data Output Status

Disabled

It is useful when an application only needs to use the discrete outputs and can allow the imager to do the decision-making. When **Disabled**, the host does not need the symbol data and the communication lines are used only for setup and status checks.

When set to **Disabled**, the imager will not transmit any data that is generated during a read cycle (symbols, No Reads, etc.)

Match

Match is used in an application that requires specific symbol information and needs to sort, route, or verify based on matching the specific symbol data.

When set to **Match**, the imager transmits symbol data whenever a symbol matches a master symbol. However, if **Matchcode Type** is **Disabled**, it transmits on any good read.

Note: A No Read can still be transmitted if **Enabled**.

Mismatch

Mismatch is typically used as a flag within the host system to prevent an item from being routed in the wrong container.

With Mismatch enabled, the imager transmits symbol data whenever the symbol data information does NOT match the master symbol.

Note: A No Read can still be transmitted if **Enabled**.

Good Read

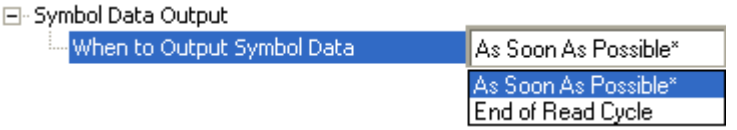
Good Read is used when an application requires all symbol data to be transmitted. It's typically used in tracking applications in which each object is uniquely identified.

With **Good Read** enabled, the imager transmits symbol data on any good read regardless of **Matchcode Type** setting.

Note: A No Read can still be transmitted if **Enabled**.

When to Output Symbol Data

This command allows the user to choose when symbol data can be sent to the host.



As Soon As Possible

As Soon As Possible is useful in applications in which symbol data needs to be moved quickly to the host, typically when the host is making decisions based on symbol data.

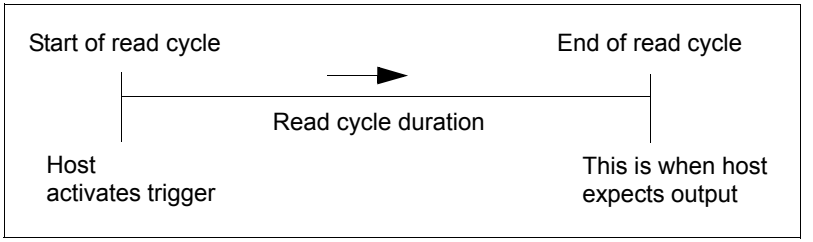
Note: More than one decode might in fact be required to qualify as a good read, depending on how **Decodes Before Output** is set.

Enabling **As Soon As Possible** causes symbol data to be sent to the host immediately after a symbol has been successfully decoded.

End of Read Cycle

End of Read Cycle is useful in timing-based systems in which the host is not ready to accept data at the time that it is decoded.

Enabling **End of Read Cycle** means that symbol data does not get sent to the host until the read cycle ends with a timeout or new trigger.



No Read Message

Used in applications where the host needs serial verification that a symbol has not been read and especially useful in new print verification.

When enabled, and if no symbol has been decoded before timeout or the end of the read cycle, the No Read message will be transmitted to the host.

No Read Message Status

Disabled

Only symbol data is output after a read cycle.

Enabled

When the imager is in a triggered mode, a No Read message will be appended for each failed read attempt.

Message

Any combination of ASCII characters can be defined as the No Read message.

Note: No Read Message will only be transmitted if **Symbol Data Output** is set to **Match**, **Mismatch**, or **Good Read**. **No Read Message** can be set to any ASCII character.

Read Duration Output

Useful in evaluating actual read cycle timing results, especially when initially setting up an application to determine maximum line speed (obtainable based on spacing between symbols.)

When enabled the duration of the read cycle (in milliseconds) is appended to the symbol data.

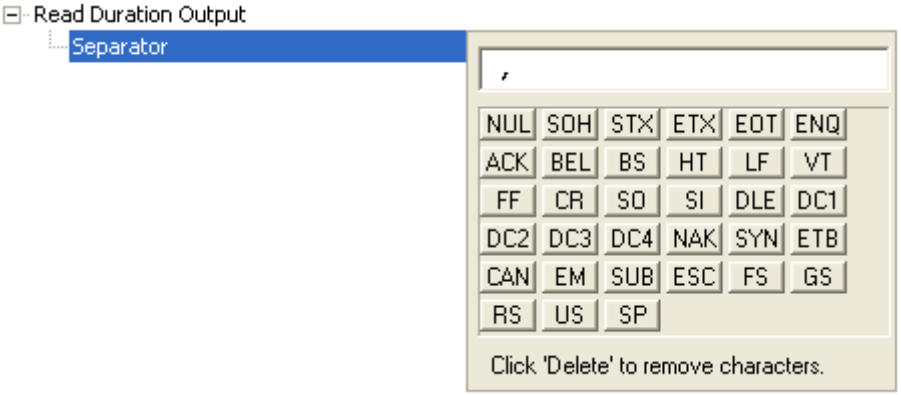
The read duration is the time from the beginning of the read cycle until data is output.

Important: To measure the entire read cycle when in **External Level** trigger mode, set **When to Output Symbol Data** to **End of Read Cycle**.

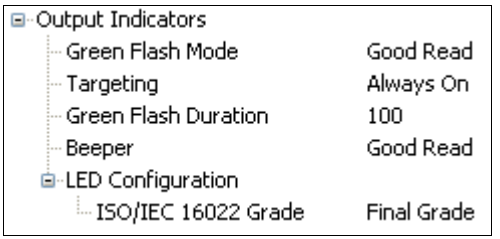
This output can measure over 49 days' worth of duration; if exceeded, the "OVERFLOW" message will be output in place of the duration.

Separator

User-defined character that separates the symbol information from the **Read Duration Output**.



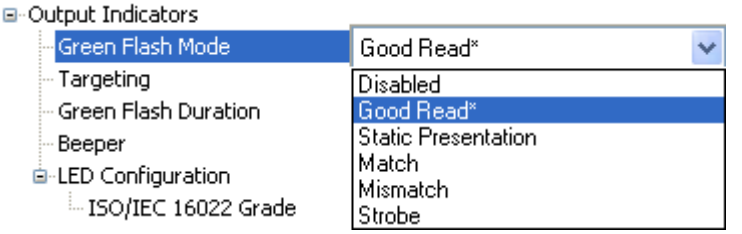
Output Indicators



The QX Hawk has a beeper and two LED arrays, as follows:

1. An array of green LEDs projected from the front of the imager that can be programmed to flash in response to user-defined conditions.
2. An array of status LEDs on the side of the imager.

Green Flash Mode



Used as a visual verification that a good read has occurred.

An array of green LEDs in the front of the imager can be programmed to flash in response to user-defined conditions.

Disabled

Green flash LEDs are disabled.

Good Read

Green flash LEDs will flash when a good read condition is met or when **Matchcode** is enabled and a match occurs.

Static Presentation

Static Presentation Mode is used in conjunction with **Continuous Read** mode.

When operating in **Static Presentation Mode**, the red LEDs will illuminate while the imager is searching for a symbol in **Continuous Read** mode. When a symbol is placed in the field of view and a good read occurs, the green LEDs will illuminate and stay on for the duration of time set in **Green Flash Duration**. Only one read will occur during that time unless more than one symbol is enabled in **Number of Symbols**.

Note: If **Static Presentation Mode** is selected but the imager is not in **Continuous Read**, the **Green Flash** will not occur.

To use Static Presentation:

1. Enable **Continuous Read**.
2. Select the number of symbols.
3. Enable **Static Presentation** in **Green Flash Mode**.
4. Select the read time in **Green Flash Duration**.

Match

The green LEDs will flash when a match condition is met. If multisymbol is enabled, then green flash LEDs will illuminate only if all symbols qualify as a match. If matchcode is disabled, then this mode will activate the LEDs on a good read.

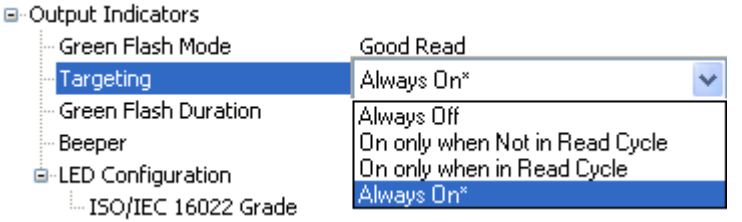
Mismatch

Same as **Match**, except that LEDs will illuminate on a mismatch.

Strobe

The green flash will be used as an illumination strobe for image capture. If it is required that the green flood is the only illumination for image capture then the internal illumination LED's can be disabled.

Targeting



Always Off

The targeting LEDs remain off.

On Only When Not In Read Cycle

The targeting LEDs illuminate while the imager is not in a read cycle. When a read cycle is entered the targeting LEDs will turn off, they will come back on upon exiting.

On Only When In Read Cycle

The targeting LEDs illuminate upon entering a read cycle, and will turn off upon exiting the read cycle.

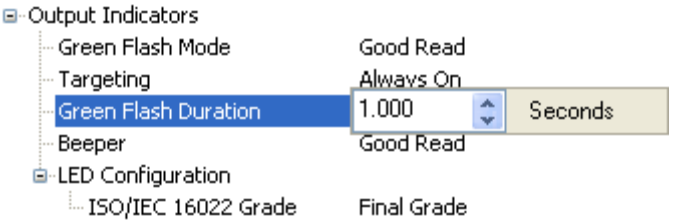
Always On

The targeting LEDs are always illuminated.

Green Flash Duration

Provides visual verification that a good read has occurred.

When a good read occurs, the green LEDs will illuminate and stay on for the time set in the **Green Flash Duration** value.



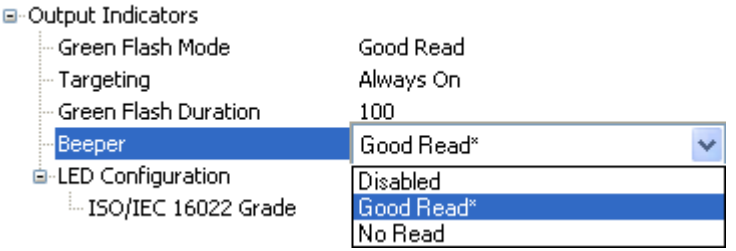
Beeper

An audible verification that either a good read or a No Read has occurred.

A beep is emitted after each good read or No Read.

Note: The beeper will also sound at any of the following times:

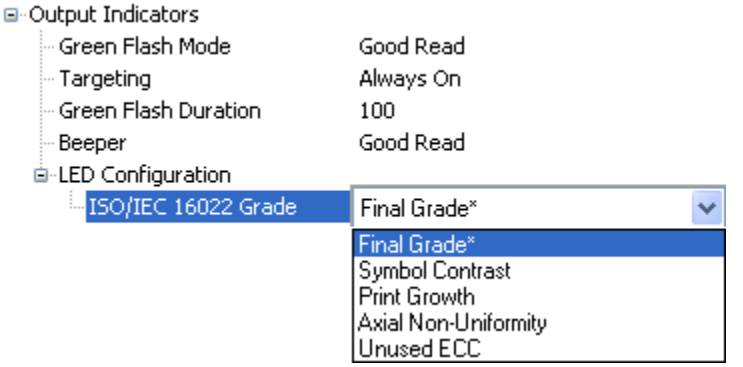
- When the imager is defaulted.
- When a **Send and Save** command is sent from ESP.
- At the conclusion of an **Auto Calibration** procedure.
- When a **<Z>**, **<Zp>**, **<Zrd>**, or **<K701,,1>** command is sent from ESP's Terminal.



LED Configuration

When the Symbol Grade Standard is set to ISO/IEC 16022 grade and the Bar Graph is configured for Grading, this parameter determines which ISO/IEC 16022 grade to display on the LED bar graph. Using the read rate scale as reference if the ISO/IEC 16022 grade result was a grade A, all the LEDs from 20% to 100% would be illuminated. If the result was a grade F, only the 20% LED would illuminate.

ISO/IEC 16022 Grade



Final Grade

LEDs represent ISO/IEC 16022 final grade.

Symbol Contrast

LEDs represent ISO/IEC 16022 Symbol Contrast grade.

Print Growth

LEDs represent ISO/IEC 16022 Print Growth grade.

Axial Non-Uniformity

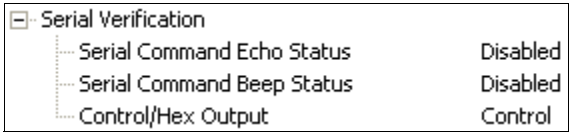
LEDs represent ISO/IEC 16022 Axial Non-Uniformity grade.

Unused ECC

LEDs represent ISO/IEC 16022 Unused ECC grade.

Serial Verification

Allows the user to verify configuration command status.

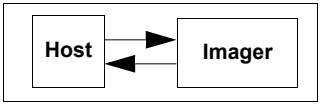


Serial Command Echo Status

This command is useful in removing any doubt about the imager's interpretation of any configuration command.

For example, if the current preamble is "SOM" and **<K701,1,START>** is entered, the imager will echo back **<K701,SOM>** since the attempted entry "START" exceeds the four character limit for that command. Therefore, it is rejected and the existing "SOM" message is echoed back and remains the preamble message.

When enabled, a configuration command received from the host is echoed back to the host with the resultant settings.



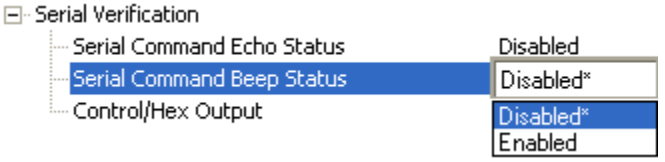
If a command with multiple fields is processed, some of the fields may have been processed properly while others were not. The changes will appear in the string echoed back so that the user will know which fields did or did not change.

Serial Command Beep Status

Used to audibly verify the acceptance and validity of a command.

Causes the imager to beep once whenever a K command is entered to indicate that the command was accepted and processed.

If an invalid command is entered, the imager beeps 5 times to indicate an invalid entry. However, this does not necessarily mean that all data fields have been entered incorrectly. Only one bad field needs to be found in order to activate the 5 beep response.

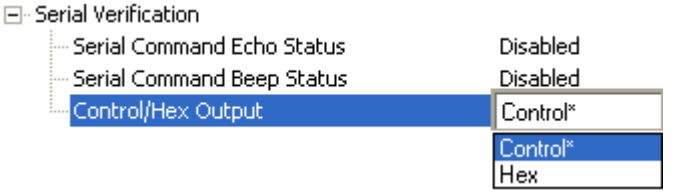


Control / Hex Output

Useful for viewing settings with binary characters when using serial commands on a terminal.

Determines the response to a **Serial Command Echo** or status request command.

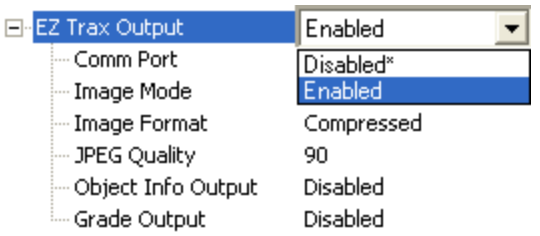
When set to **Control**, two characters are transmitted to represent a non-displayable character. For example, a carriage return will be shown as: **^M**.



EZ Trax Output

EZ Trax Output Status

When EZ Trax output is enabled, the imager will attempt to output all enabled EZ Trax options. EZ Trax will not function unless enabled.



Comm Port

Selects the communication port that will be used to transfer image files.

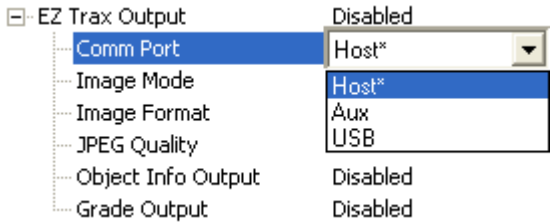


Image Mode

Determines which read cycle condition triggers image file output.

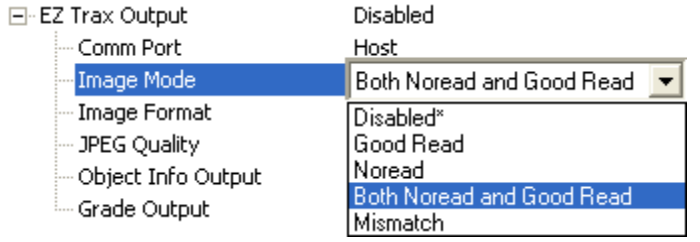
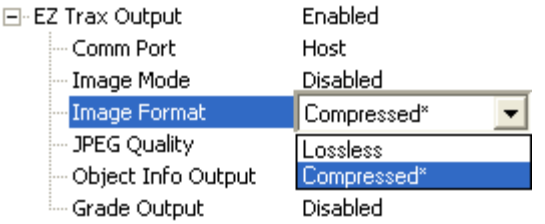


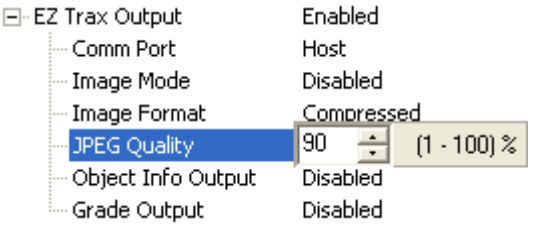
Image Format

Selects the format of the image output file.



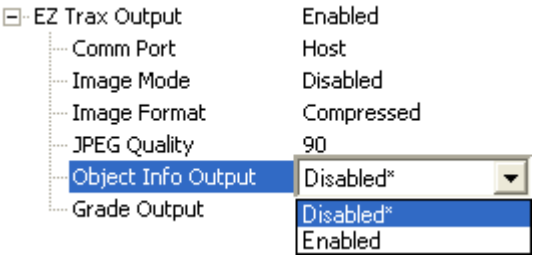
JPEG Quality

Sets the amount of JPEG image compression. A value of **1** represents the highest compression and lowest image quality, and **100** represents the lowest compression and highest image quality.



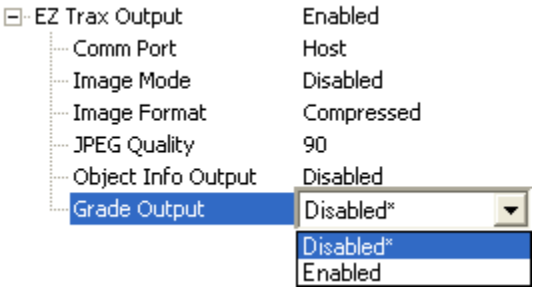
Object Info Output

If a symbol is decoded during an image capture, the symbol type and other supplementary symbol information is also included.



Grade Output

Symbol quality information will be output in the form of an abbreviated identifier for each read cycle.



EZ Button

Serves as a master switch to enable/disable the EZ Button status.

EZ Button	Enabled
Default On Power-on	Enabled
Load Config DB	Enabled
Save For Power-on	Disabled
Single Beep	Target System
Two Beeps	Calibrate
Three Beeps	Read Rate
Four Beeps	Save for Power-on

The EZ Button has four positions: **Single Beep**, **Two Beeps**, **Three Beeps**, and **Four Beeps**, selectable by the length of time the button is held down, and indicated by one, two, three, and four beeps in succession. Each position can be programmed for any of eight **EZ Button Modes**.

EZ Button Status

Disabled

When set to **Disabled**, the EZ Button does not function.

Enabled

When selected, the EZ Button is enabled and the function of each button position is selected by the **EZ Button Modes** command.

Trigger

When selected, the EZ Button acts as a trigger for the imager to start and end read cycles. All other button operations are inactive.

In External Level:	The read cycle endures for as long as the EZ Button is pressed, unless a timeout occurs and **End of Read Cycle Mode** is set to **Timeout**.
In External Edge:	As with **External Level**, **External Edge** allows a read cycle to be initiated by pressing the EZ Button, but unlike **External Level**, the read cycle ends with a good read output, a timeout, or a new trigger.

Unlatch Outputs

In this configuration, the EZ Button will unlatch any logic outputs that have been latched.

Parameter Switch

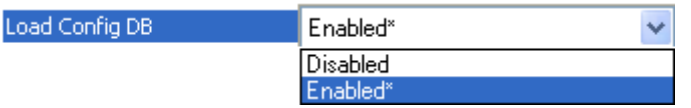
The parameter switch toggles between custom defaults and power-on settings. The condition is the same as that achieved by sending the **<Arc>** and **<Arp>** commands consecutively.

Default on Power-On

When enabled, if the EZ Button is held down on power-on, the imager will default to customer defaults and save for power-on. This is the same as sending a **<Zrc>** command from ESP's Terminal.

Load Configuration Database

Loads Configuration Database settings to the imager.



Save for Power-On

Saves imager settings for Power-On.

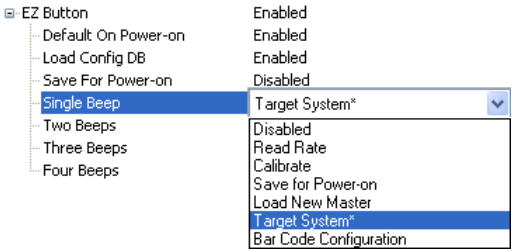
EZ Button Modes

Useful for performing multiple, repetitive tasks at the work site.

Allows the user to program each of the EZ Button's **4** positions from a selection of **7** modes.

Single Beep

Hold down button until a single beep is heard (and the 20% LED illuminates).



Disabled

When set to **Disabled**, the associated button position will have no function associated with it, and the position will be skipped over.

Read Rate

Read Rate is initiated when the associated button position is selected. Read Rate will perform decodes/second and is the same as sending a **<C>** from ESP's Terminal. To exit Read Rate, quickly press and release the EZ Button.

Calibrate

Calibrate is initiated when the associated button position is selected. To cancel Calibration, quickly press and release the EZ Button.

Save for Power-On

All imager settings will be saved to non-volatile memory to be recalled on power-on whenever the associated button position is selected. This is the same as sending a **<Z>** from ESP's Terminal.

Load New Master

Functions in the same way as **New Master Pin** input whenever the associated button position is selected.

Target System

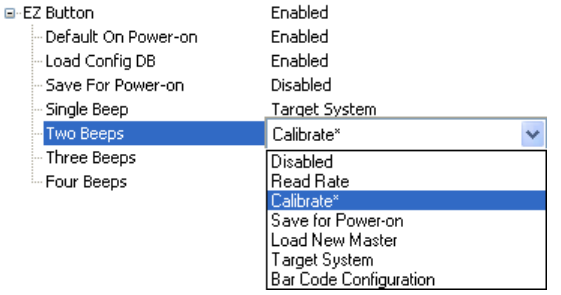
When the imager reaches this position, the targeting pattern appears. The targeting pattern remains illuminated even if a different position is subsequently selected until this position selection is disabled.

Bar Code Configuration

Enables **Bar Code Configuration Mode** whenever the associated button position is selected. When enabled, the imager can accept configuration commands from symbols. To disable, quickly press and release the EZ Button.

Two Beeps

Hold down button until two quick beeps are heard (and the 20% and 40% LEDs illuminate.)



Disabled

When set to **Disabled**, the associated button position will have no function associated with it, and the position will be skipped over.

Read Rate

Read Rate is initiated when the associated button position is selected. Read Rate will perform decodes/second and is the same as sending a **<C>** from ESP's Terminal. To exit Read Rate, quickly press and release the EZ Button.

Calibrate

Calibrate is initiated when the associated button position is selected. To cancel Calibration, quickly press and release the EZ Button.

Save for Power-On

All imager settings will be saved to non-volatile memory to be recalled on power-on whenever the associated button position is selected. This is the same as sending a **<Z>** from ESP's Terminal.

Load New Master

Functions in the same way as **New Master Pin** input whenever the associated button position is selected.

Target System

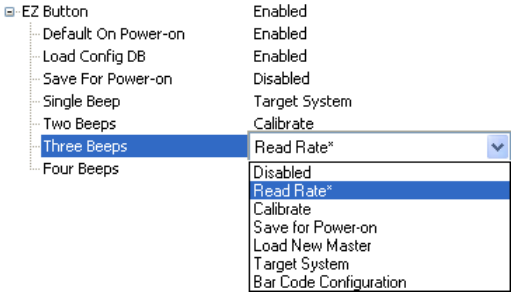
When the imager reaches this position, the targeting pattern appears. The targeting pattern remains illuminated even if a different position is subsequently selected until this position selection is disabled.

Bar Code Configuration

Enables **Bar Code Configuration Mode** whenever the associated button position is selected. When enabled, the imager can accept configuration commands from symbols. To disable, quickly press and release the EZ Button.

Three Beeps

Hold down button until three quick beeps are heard (and the 20%, 40%, and 60% LEDs illuminate).



Disabled

When set to **Disabled**, the associated button position will have no function associated with it, and the position will be skipped over.

Read Rate

Read Rate is initiated when the associated button position is selected. Read Rate will perform decodes/second and is the same as sending a **<C>** from ESP's Terminal. To exit Read Rate, quickly press and release the EZ Button.

Calibrate

Calibrate is initiated when the associated button position is selected. To cancel Calibration, quickly press and release the EZ Button.

Save for Power-On

All imager settings will be saved to non-volatile memory to be recalled on power-on whenever the associated button position is selected. This is the same as sending a **<Z>** from ESP's Terminal.

Load New Master

Functions in the same way as **New Master Pin** input whenever the associated button position is selected.

Target System

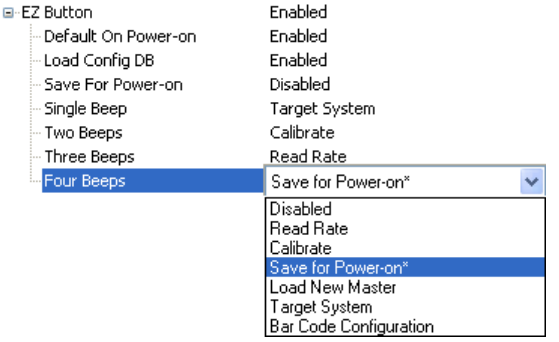
When the imager reaches this position, the targeting pattern appears. The targeting pattern remains illuminated even if a different position is subsequently selected until this position selection is disabled.

Bar Code Configuration

Enables **Bar Code Configuration Mode** whenever the associated button position is selected. When enabled, the imager can accept configuration commands from symbols. To disable, quickly press and release the EZ Button.

Four Beeps

Hold down button until four quick beeps are heard (and the 20%, 40%, 60%, and 80% LEDs illuminate).



Disabled

When set to **Disabled**, the associated button position will have no function associated with it, and the position will be skipped over.

Read Rate

Read Rate is initiated when the associated button position is selected. Read Rate will perform decodes/second and is the same as sending a **<C>** from ESP's Terminal. To exit Read Rate, quickly press and release the EZ Button.

Calibrate

Calibrate is initiated when the associated button position is selected. To cancel Calibration, quickly press and release the EZ Button.

Save for Power-On

All imager settings will be saved to non-volatile memory to be recalled on power-on whenever the associated button position is selected. This is the same as sending a **<Z>** from ESP's Terminal.

Load New Master

Functions in the same way as **New Master Pin** input whenever the associated button position is selected.

Target System

When the imager reaches this position, the targeting pattern appears. The targeting pattern remains illuminated even if a different position is subsequently selected until this position selection is disabled.

Bar Code Configuration

Enables **Bar Code Configuration Mode** whenever the associated button position is selected. When enabled, the imager can accept configuration commands from symbols. To disable, quickly press and release the EZ Button.

Status Indicators

The side of the QX Hawk features an array of LEDs that indicate various aspects of imager activity.

Status Indicators	PHY Activity
Bar Graph	Read Rate / Good Read
I/O 1	Output Active
I/O 2	Input Active

Controls the operation of the MOD/ACT and NET/LNK LEDs.

Note: MOD and ACT function as one combined LED, as do NET and LNK.

Disabled

When set to **Disabled**, the MOD/ACT and NET/LNK LEDs are always off.

Note: All green and red LEDs will turn on briefly during power-on or reset to confirm that they are functioning.

PHY Activity

If Ethernet is available:

LNK = Solid green when transceiver is linked.

ACT = Blinking green when transceiver detects Tx or Rx activity.

Otherwise, for all RS232 and RS422/485 activity:

LNK = Blinking green with Tx data activity.

ACT = Blinking green with Rx data activity.

Note: Red is never turned on.

Protocol Activity

If EtherNet/IP is enabled:

MOD = Module status, per EtherNet/IP specification

NET = Network status, per EtherNet/IP specification

Otherwise, the MOD and NET LEDs are always off.

Bar Graph

Read Rate, Auto Calibration, Bar Code Configuration, and Read Cycle Result all share the Bar Graph (20% – 100%) LEDs.

I/O 1

I/O 1 always shows the combined state of the discrete outputs. If any output is active, the I/O 1 LED will be on.

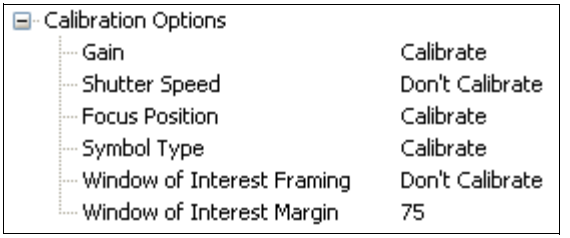
I/O 2

I/O 2 always shows the state of the hardware input trigger. If the trigger is active, I/O 2 will be on.

Calibration Options

This command specifies the operation of the calibration feature. The default configuration is setup to perform calibration on gain, focus and symbol type. Shutter speed is disabled as the default setting, since shutter speed is more of an application specific parameter and normally should be configured by the user to meet the requirements of the application. The calibration process will optimize the gain setting for the configured shutter speed (Camera).

Note: Background color (Reverse Video) is part of the calibration process, regardless of the calibration setup. After successful completion of calibration, the background color will be set to the appropriate value depending on the calibrated symbol. The mirrored image parameter is not part of the calibration process, and must be configured appropriately by the user prior to calibration (Mirrored Image).



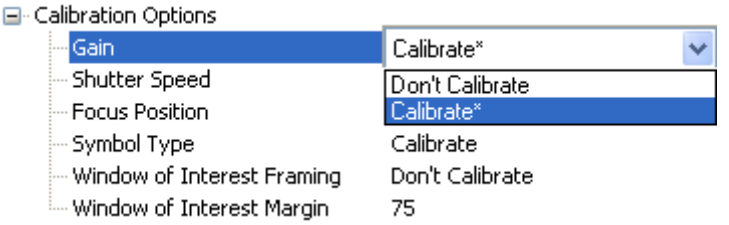
Gain

Disabled

The gain is fixed and is not part of the calibration process.

Enabled

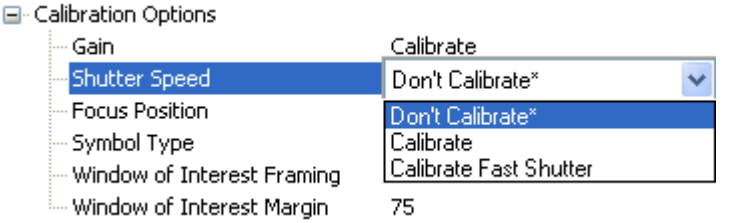
The gain will be calibrated to provide the best image quality and performance.



Shutter Speed

Unless an application is a static setup, the shutter speed setting should be configured by the user based on their application. For dynamic applications the user should configure the shutter speed setting, so the calibration process can optimize the gain for that setting. The following table illustrates a general guide-line for shutter speed configurations for various line speeds.

Note: This is a general guide line, and depends on the scanners optical configuration and symbol element size.



Don't Calibrate

The shutter speed is fixed and is not part of the calibration process.

Calibrate

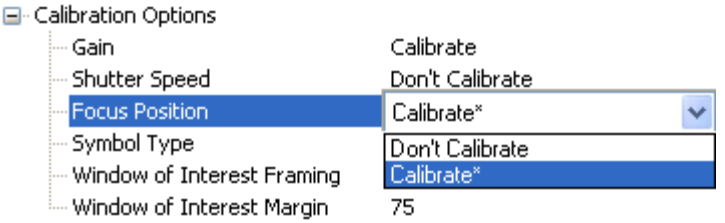
The shutter speed will be calibrated to provide the best image quality and performance.

Calibrate Fast Shutter

The calibration process will concentrate on achieving the fastest possible shutter setting that still will still have good performance. The image quality or contrast may not be as good as what would be achieved with the "Enabled" setting. The calibration process is not designed to choose the fastest shutter speed that can decode a symbol, but rather to optimize for the fastest shutter speed that still provides good image quality.

Focus Position

Since the focus can be configured by simply entering the target distance value from the imager, normally the user will configure the focus without requiring calibration. However, if it is necessary to calibrate the focus distance there are two methods to accommodate this task.



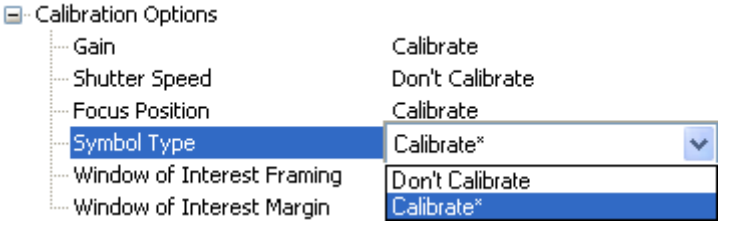
Don't Calibrate

The focus position is fixed and is not part of the calibration process.

Calibrate

The focus position will be calibrated to provide the best image quality and performance. This method is a simply "Search" method that tries to identify the desired focus through a search algorithm that cycles through focus settings, with a configuration of camera settings to try and locate as quickly as possible the desired focus. This is accomplished when a symbol is decoded. Once a focus distance has been located that will successfully decode a symbol, the algorithm will fine tune the search to locate the inside and outside focal distances. The final focus distance is selected as the focus distance that is in the center of these two values. This method can be time consuming if the focus is not found on the 1st pass.

Symbol Type



Don't Calibrate

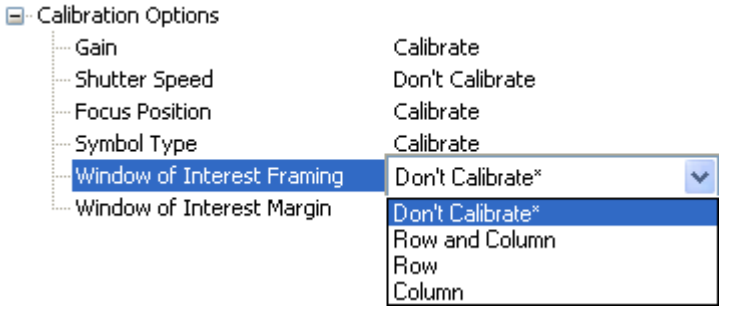
Only the current symbologies enabled will be considered during the calibration process.

Calibrate

Autodiscrimination is in effect during the calibration process. All symbologies readable by the product, except PDF417 and Pharmacode will be attempted during calibration. Any new symbologies successfully decode during calibration will remain enabled at the end of the process. All enabled symbologies will remain enabled. For example, assume that only Code 39 is enabled at the beginning of calibration. If a Code 128 symbol is read during calibration, then Code 128 as well as Code 39 will thereafter be enabled.

Window of Interest Framing

If a WOI framing mode is enabled, when calibration begins it will set the camera WOI to a full size image. Once a symbol is decoded, the camera WOI will be zoomed in both vertically and horizontally (regardless which WOI mode is enabled) to include the symbol plus an additional margin. This is done to speed up the calibration process. When calibration completes, and is successful, then the camera WOI will be adjusted according to the mode enabled. Otherwise, the original WOI configuration will be retained.



Don't Calibrate

The Window of Interest is not modified after the completion of Calibration.

Row and Column

If the calibration process is successful the Window of Interest will be modified to frame the symbol plus an addition margin area around the symbol, determined by the “WOI margin” parameter.

Row

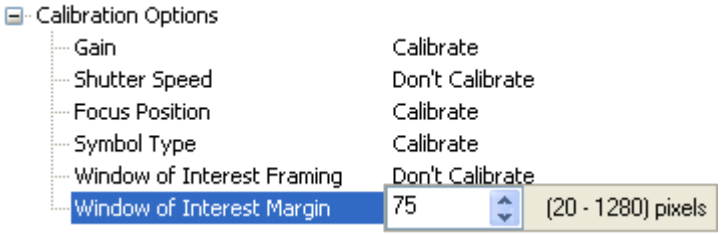
If the calibration process is successful the Window of Interest rows will be modified to horizontally frame the symbol plus an addition margin determined by the “WOI margin” parameter.

Column

If the calibration process is successful the Window of Interest columns will be modified to vertically frame the symbol plus an addition margin determined by the “WOI margin” parameter.

Window of Interest Margin

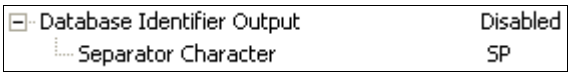
Sets the margin size that is applied to the calibrated label, and is specified in number of pixels. If margin causes image to exceed maximum image size, it will be reduced accordingly.



Database Identifier Output

Useful in tracking which database entries read which symbols.

Database Identifier Output Status



Disabled

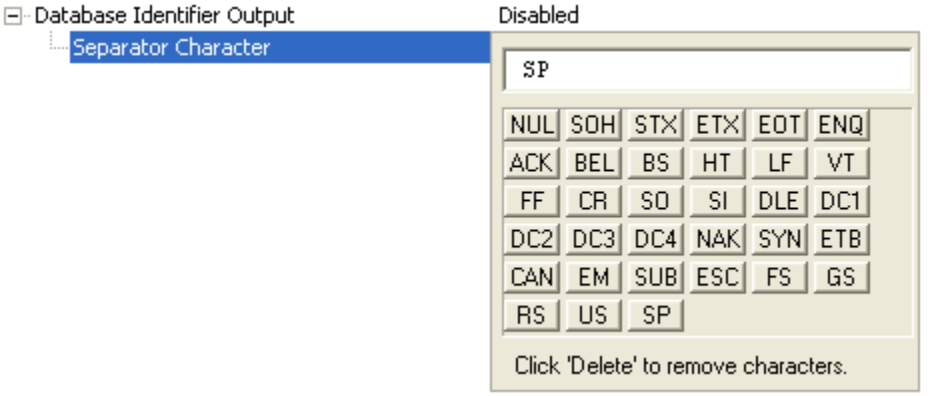
When this command is disabled, no database identifier information will be output.

Enabled

When this command is enabled, the imager will append a two-digit number and the characters “DB” to the data output following the separator for each symbol decoded using **Configuration Database**. For example, if the separator is an underscore character and the second database entry reads a symbol encoded with “data capture” during the read cycle, the symbol data output will be “data capture_DB02”. If the database is not active, no identifiers will be attached to output.

Separator Character

The separator character separates the symbol data from the database identifier.



Input 1

Input Mode

Determines the function of the Input pin.

Disabled

When set to **Disabled**, the Input pin has no impact on operation.

Reset Counts

When set to **Reset Counts**, a transition to the active state of the Input will cause the imager to reset the internal counters.

Unlatch Output

This setting is used in combination with any of the three outputs in **Latch Mode 1 (Unlatch Input # 1 Pin)**. A transition to the active state will clear any of the three outputs that were previously latched.

Active State

Active Open

Input function is activated when input state is de-energized.

Active Closed

Input function is activated when input state is energized.

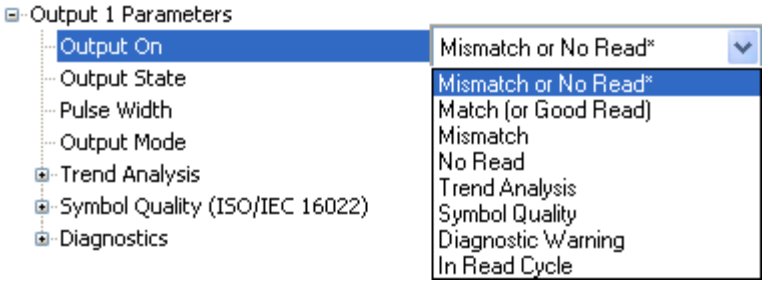
Output 1 Parameters

Output On

Output On provides discrete signalling to host software to control external devices such as PLCs and relays. It is useful for routing, sorting, and to prevent mis-packaging and mis-routing.

Sets the discrete output functions for specific user-selected conditions. Allows the user to set the conditions under which an output (or outputs) will be activated.

Note: If **Output On** is set to **Match** or **Mismatch**, a transition (switching) will not occur unless **Matchcode Type** is enabled and a master symbol is loaded into memory.



Mismatch or No Read

Activates discrete output when the data does not match that of the master symbol or the symbol has not been decoded before the end of the read cycle.

Good Read / Match

Activates a discrete output when the symbol data matches the master symbol.

Note: To output on **Good Read** when **Matchcode** is not enabled, enable any output for **Match**.

Mismatch

Activates a discrete output whenever the symbol data does not match that of the master symbol.

No Read

Activates a discrete output whenever the symbol data is not decoded before the end of the read cycle.

Trend Analysis

Typically used when successful decodes are occurring but a discrete output is needed to flag a trend in quality issues.

Activates discrete output when a trend analysis condition is met, depending on the trend analysis option enabled.

Diagnostic Warning

Typically used when a discrete indication of a diagnostic condition is needed.

Activates discrete output when a diagnostic warning condition is met, depending on the diagnostic option enabled.

In Read Cycle

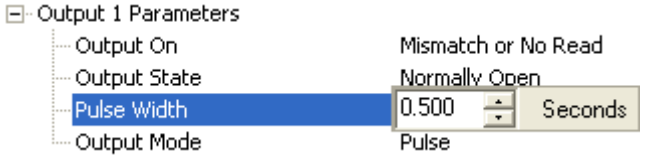
Activates a discrete output when the imager is in a read cycle.

Output State

Sets the active electrical state of the discrete output.

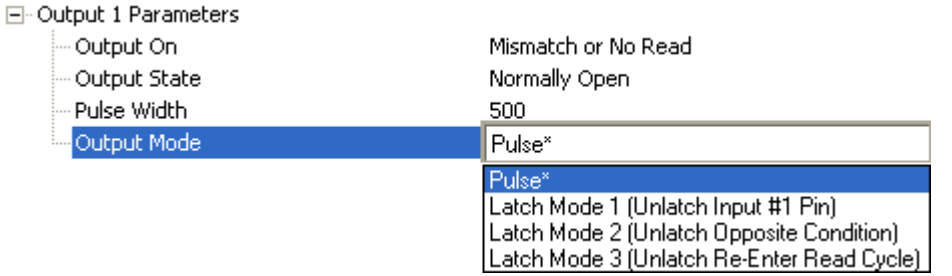
Pulse Width

Sets the time that the discrete output remains active.



Output Mode

Sets the condition in which the discrete output is de-activated.



Pulse

This is the default mode of operation in which the programmable output is activated when the **Output On** condition has been met and held active for the duration of the selected pulse width.

Latch Mode 1 (Unlatch Input # 1 Pin)

The programmable output is activated when the **Output On** condition has been met and held active until the **Input # 1 Pin** transitions.

Note: **Input 1** must be set to **Unlatch Output** for Latch Mode 1 to function.

If the Output Condition is set to **Read Cycle Data Valid**, then the read cycle will wait for Input 1 to unlatch the output before continuing on. This is to provide system handshake ability despite communication channel. The read cycle data must leave all channels before **Read Cycle Data Valid** will output.

Latch Mode 2 (Unlatch Opposite Condition)

The programmable output is activated when the **Output On** condition has been met and held active until the opposite condition selected under **Output On** has been met.

For example, if **No Read** is enabled under **Output On**, the programmable output will go active on a No Read and remain active until the opposite condition, a good read, occurs.

If the Output Condition is set to **Read Cycle Data Valid**, then the read cycle will continue but every new **Read Cycle Data Valid** event causes the output to change state to the opposite condition. This provides a toggle event per every read cycle output. The only known outout state will be the on a power-on or reset. After reading begins, the state becomes undetermined. Only the state change itself has meaning—not the absolute value.

Latch Mode 3 (Unlatch Re-enter Read Cycle)

The programmable output is activated when the **Output On** condition has been met and held active until a new read cycle begins.

Note: All of the **Output On** modes are inhibited when any **Diagnostic Warning** is active for **Output 1**.

Trend Analysis

Note: Output On under **Output 1 Parameters** must be set to **Trend Analysis** for this output to function.

Under **Output 1 Parameters**, expand the **Trend Analysis** tree.

Useful in cases where the user doesn't want to shut down for one condition but wants to monitor quality and read conditions.

Applies **Trend Analysis** settings to **Output 1**.

With **Trend Analysis**, the user can track the occurrences and frequency of mismatches, No Reads, and the number of reads per trigger, and output the results to any of three outputs.

Trend Analysis Mode = No Read

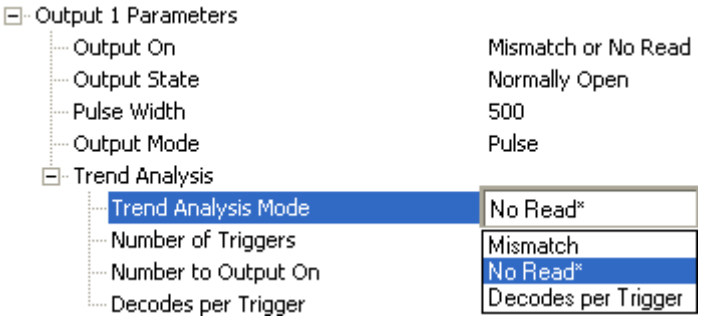
Trigger Evaluation Period = 25 triggers (read cycles)

Number to Output On = 4

In this example, the imager will activate an output when 4 No Reads occur within a period of 25 triggers (read cycles).

Trend Analysis Mode

Sets the trend condition (**Mismatch**, **No Read**, **Decodes per Trigger**, **Bad Symbol**, or **No Symbol**) that will activate the output.



Mismatch

Output will be activated when the number of mismatches equals the value entered for **Number to Output On** within the trigger window selected in **Number of Triggers**.

No Read

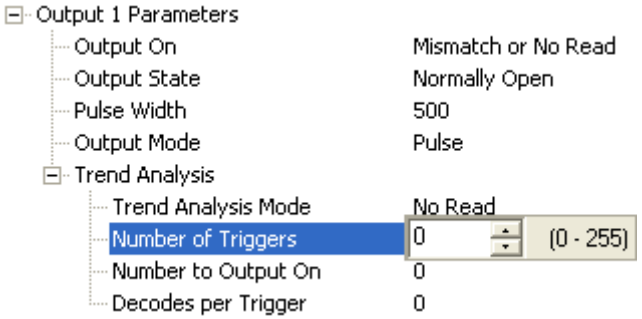
Output will be activated when the number of No Reads equals the value entered for **Number to Output On** within the trigger window selected in **Number of Triggers**.

Decodes per Trigger

Output will be activated when the number of decodes equals the value entered for **Number to Output On** within the trigger window selected in **Number of Triggers**.

Number of Triggers

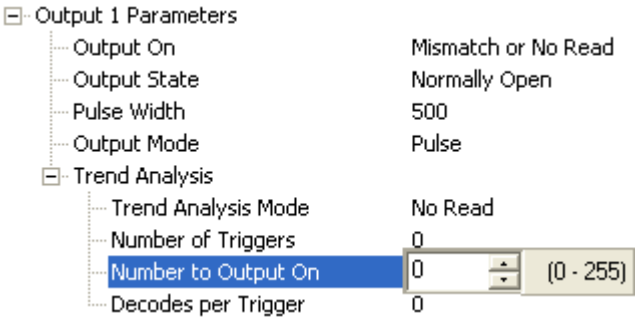
The number of triggers to examine for the trend analysis condition.



Number to Output On

Example: If **Number to Output On** is set to 3 and **Trend Analysis Mode** is set to **No Read**, then the output will not be activated until 3 No Reads have occurred.

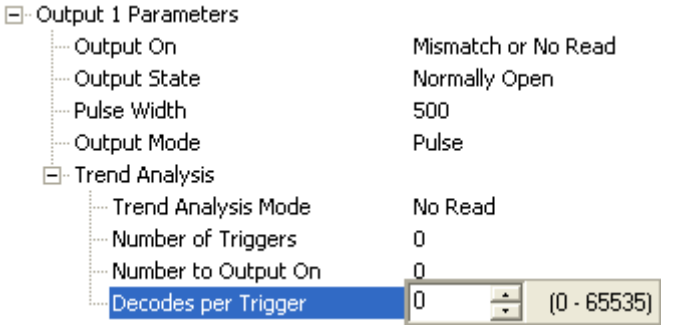
Sets the number of **Trend Analysis Mode** events (mismatches, No Reads, or reads/trigger as configured by **Trend Analysis Mode**) to occur within the trigger evaluation period before activating the associated output.



Decodes per Trigger

When set to this mode, and when the appropriate output is set to output on trend analysis, the imager will function in a **Decodes per Trigger** mode during the read cycle and the trend analysis operation. Output will be activated based on whether or not the symbol decode count at the end of the read cycle crosses the decodes per trigger threshold.

Note: Although this setup causes the imager to function in a **Decodes per Trigger** mode, the decode count will only be appended to the symbol data if the status of the **Decodes per Trigger** command is enabled.



Symbol Quality (ISO/IEC 16022)

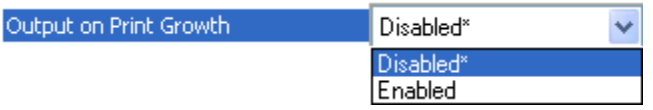
Symbol Quality (ISO/IEC 16022)	
Output on Symbol Contrast	Disabled
Output on Print Growth	Disabled
Output on Axial Non-uniformity	Disabled
Output on Unused ECC	Disabled
Symbol Contrast Threshold	Grade C
Print Growth Threshold	Grade C
Axial Non-uniformity Threshold	Grade C
Unused ECC Threshold	Grade C

Output on Symbol Contrast

The symbol contrast is formatted and attached to the Data Matrix symbol data as either a grade or value.

Output on Print Growth

The print growth is formatted and attached to the Data Matrix symbol data as either a grade or value.

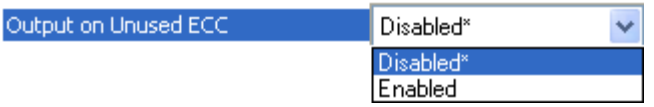


Output on Axial Non-Uniformity

The axial non-uniformity is formatted and attached to the Data Matrix symbol data as either a grade or value.

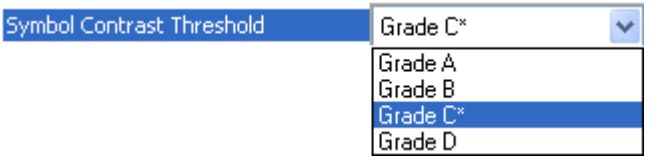
Output On Unused ECC

The unused ECC is formatted and attached to the Data Matrix symbol data as either a grade or value.



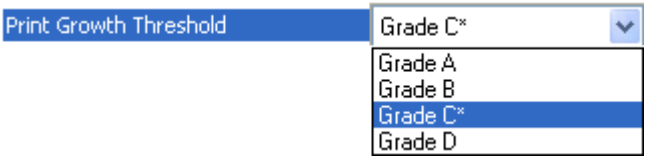
Symbol Contrast Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Symbol Contrast grade is under the threshold.



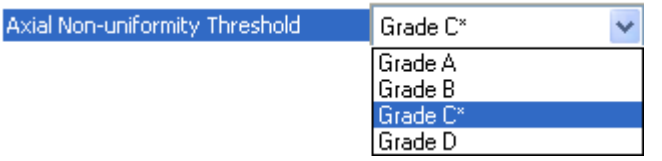
Print Growth Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Print Growth grade is under the threshold.



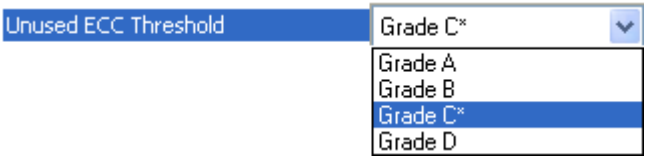
Axial Non-Uniformity Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Axial Non-Uniformity grade is under the threshold.



Unused ECC Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Unused ECC grade is under the threshold.



Diagnostics

Note: Output On under **Output 1 Parameters** must be set to **Diagnostic Warning** for this output to function.

Under **Output 1 Parameters**, expand the **Diagnostics** tree.

When **Diagnostic Warning** is enabled, the **Output On** configuration has no effect. The output will remain active as long as one of the diagnostic warning conditions is met. The output will become inactive once it detects that there are no diagnostic warning conditions.

Service Unit

Allows the user to set up the output to toggle to active when the service timer has expired. This condition will only be held for one service timer click.

Note: This feature cannot be used if the imager is in **Continuous Read**.

When **Service Unit** is enabled, a message of up to 10 ASCII characters is sent whenever the system detects that the service timer's limit has been reached. The service timer is reset at power-on, meaning that the service timer's limit is the amount of time since last reset. Service timer increments can be set in seconds or minutes.

Output 2 Parameters

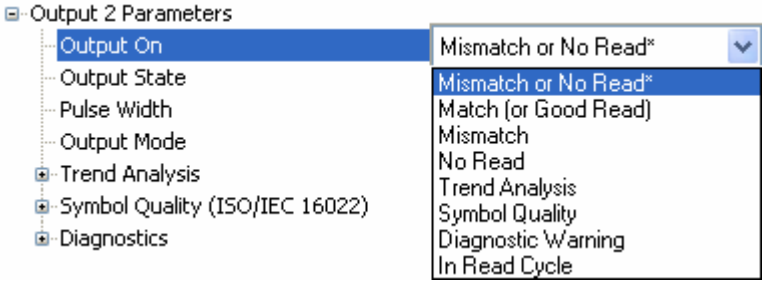
Output 2 has the same parameters and default settings as **Output 1**.

Output On

Output On provides discrete signalling to host software to control external devices such as PLCs and relays. It is useful for routing, sorting, and to prevent mis-packaging and mis-routing.

Sets the discrete output functions for specific user-selected conditions. Allows the user to set the conditions under which an output (or outputs) will be activated.

Note: If **Output On** is set to **Match** or **Mismatch**, a transition (switching) will not occur unless **Matchcode Type** is enabled and a master symbol is loaded into memory.



Mismatch or No Read

Activates discrete output when the data does not match that of the master symbol or the symbol has not been decoded before the end of the read cycle.

Good Read / Match

Activates a discrete output when the symbol data matches the master symbol.

Note: To output on **Good Read** when **Matchcode** is not enabled, enable any output for **Match**.

Mismatch

Activates a discrete output whenever the symbol data does not match that of the master symbol.

No Read

Activates a discrete output whenever the symbol data is not decoded before the end of the read cycle.

Trend Analysis

Typically used when successful decodes are occurring but a discrete output is needed to flag a trend in quality issues.

Activates discrete output when a trend analysis condition is met, depending on the trend analysis option enabled.

Diagnostic Warning

Typically used when a discrete indication of a diagnostic condition is needed.

Activates discrete output when a diagnostic warning condition is met, depending on the diagnostic option enabled.

In Read Cycle

Activates a discrete output when the imager is in a read cycle.

Output State

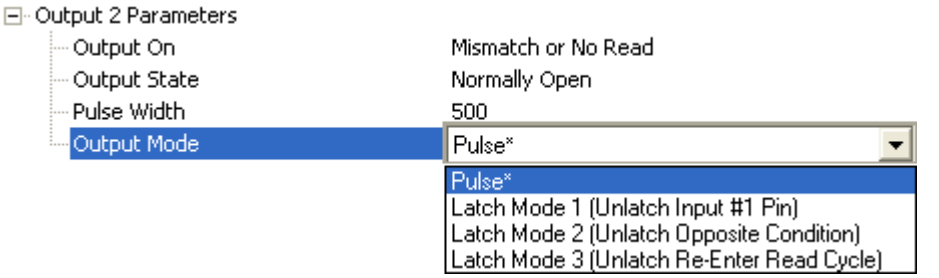
Sets the active electrical state of the discrete output.

Pulse Width

Sets the time in 10 ms increments that the discrete output remains active.

Output Mode

Sets the condition in which the discrete output is de-activated.



Pulse

This is the default mode of operation in which the programmable output is activated when the **Output On** condition has been met and held active for the duration of the selected pulse width.

Latch Mode 1 (Unlatch Input # 1 Pin)

The programmable output is activated when the **Output On** condition has been met and held active until the **Input # 1 Pin**.

Note: Input 1 must be set to **Unlatch Output** for Latch Mode 1 to function.

If the Output Condition is set to **Read Cycle Data Valid**, then the read cycle will wait for Input 1 to unlatch the output before continuing on. This is to provide system handshake ability despite communication channel. The read cycle data must leave all channels before **Read Cycle Data Valid** will output.

Latch Mode 2 (Unlatch Opposite Condition)

The programmable output is activated when the **Output On** condition has been met and held active until the opposite condition selected under **Output On** has been met.

For example, if **No Read** is enabled under **Output On**, the programmable output will go active on a No Read and remain active until the opposite condition, a good read, occurs.

If the Output Condition is set to **Read Cycle Data Valid**, then the read cycle will continue but every new **Read Cycle Data Valid** event causes the output to change state to the opposite condition. This provides a toggle event per every read cycle output. The only known outout state will be the on a power-on or reset. After reading begins, the state becomes undetermined. Only the state change itself has meaning—not the absolute value.

Latch Mode 3 (Unlatch Re-enter Read Cycle)

The programmable output is activated when the **Output On** condition has been met and held active until a new read cycle begins.

Note: All of the **Output On** modes are inhibited when any **Diagnostic Warning** is active for **Output 2**.

Trend Analysis

Note: Output On under **Output 2 Parameters** must be set to **Trend Analysis** for this output to function.

Under **Output 2 Parameters**, expand the **Trend Analysis** tree.

Useful in cases where the user doesn't want to shut down for one condition but wants to monitor quality and read conditions.

Applies **Trend Analysis** settings to **Output 2**.

With **Trend Analysis**, the user can track the occurrences and frequency of mismatches, No Reads, and the number of reads per trigger, and output the results to any of three outputs.

Trend Analysis Mode = No Read

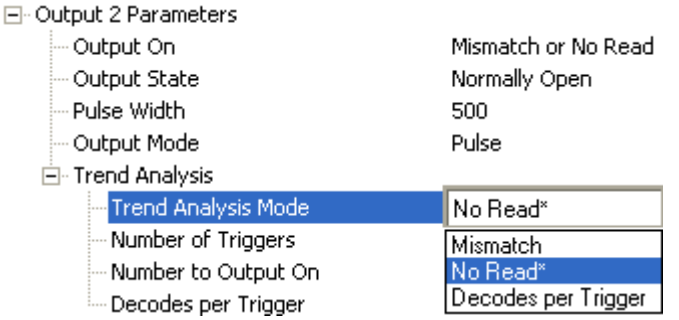
Trigger Evaluation Period = 25 triggers (read cycles)

Number to Output On = 4

In this example, the imager will activate an output when 4 No Reads occur within a period of 25 triggers (read cycles).

Trend Analysis Mode

Sets the trend condition (**Mismatch**, **No Read**, **Decodes per Trigger**, **Bad Symbol**, or **No Symbol**) that will activate the output.



Mismatch

Output will be activated when the number of mismatches equals the value entered for **Number to Output On** within the trigger window selected in **Number of Triggers**.

No Read

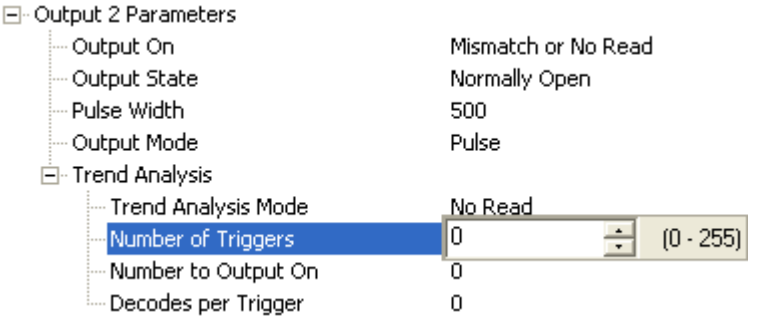
Output will be activated when the number of No Reads equals the value entered for **Number to Output On** within the trigger window selected in **Number of Triggers**.

Decodes per Trigger

Output will be activated when the number of decodes equals the value entered for **Number to Output On** within the trigger window selected in **Number of Triggers**.

Number of Triggers

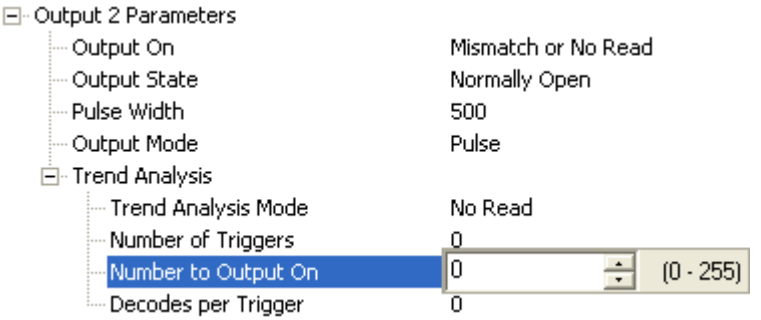
The number of triggers to examine for the trend analysis condition.



Number to Output On

Example: If **Number to Output On** is set to 3 and **Trend Analysis Mode** is set to **No Read**, then the output will not be activated until 3 No Reads have occurred.

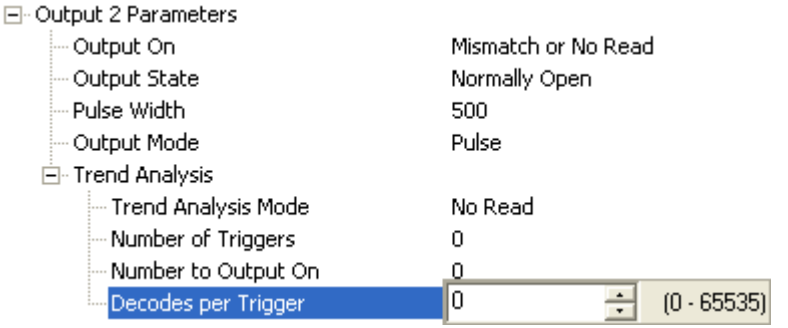
Sets the number of **Trend Analysis Mode** events (mismatches, No Reads, or reads/trigger as configured by **Trend Analysis Mode**) to occur within the trigger evaluation period before activating the associated output.



Decodes per Trigger

When set to this mode, and when the appropriate output is set to output on trend analysis, the imager will function in a **Decodes per Trigger** mode during the read cycle and the trend analysis operation. Output will be activated based on whether or not the symbol decode count at the end of the read cycle crosses the decodes per trigger threshold.

Note: Although this setup causes the imager to function in a **Decodes per Trigger** mode, the decode count will only be appended to the symbol data if the status of the **Decodes per Trigger** command is enabled.



Symbol Quality (ISO/IEC 16022)

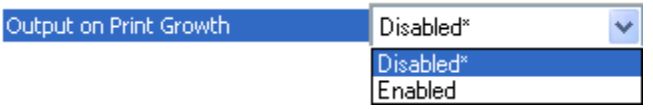
Symbol Quality (ISO/IEC 16022)	
Output on Symbol Contrast	Disabled
Output on Print Growth	Disabled
Output on Axial Non-uniformity	Disabled
Output on Unused ECC	Disabled
Symbol Contrast Threshold	Grade C
Print Growth Threshold	Grade C
Axial Non-uniformity Threshold	Grade C
Unused ECC Threshold	Grade C

Output on Symbol Contrast

The symbol contrast is formatted and attached to the Data Matrix symbol data as either a grade or value.

Output on Print Growth

The print growth is formatted and attached to the Data Matrix symbol data as either a grade or value.

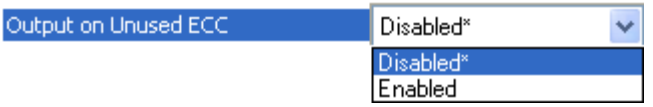


Output on Axial Non-Uniformity

The axial non-uniformity is formatted and attached to the Data Matrix symbol data as either a grade or value.

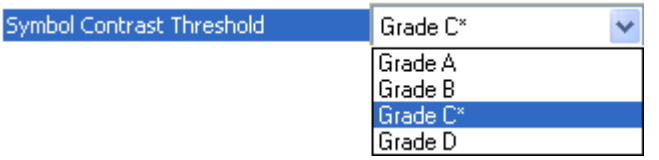
Output On Unused ECC

The unused ECC is formatted and attached to the Data Matrix symbol data as either a grade or value.



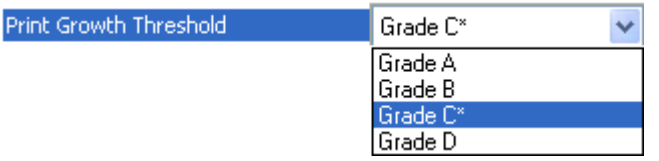
Symbol Contrast Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Symbol Contrast grade is under the threshold.



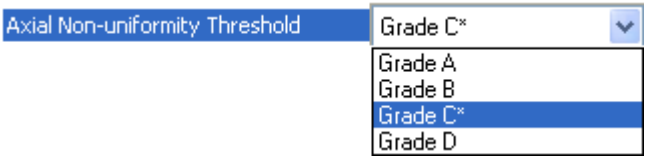
Print Growth Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Print Growth grade is under the threshold.



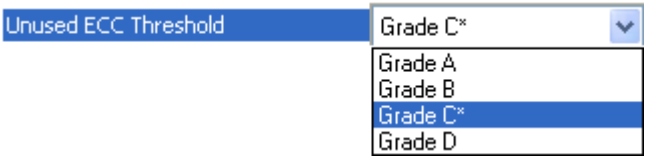
Axial Non-Uniformity Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Axial Non-Uniformity grade is under the threshold.



Unused ECC Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Unused ECC grade is under the threshold.



Diagnostics

Note: Output On under **Output 2 Parameters** must be set to **Diagnostic Warning** for this output to function.

Under **Output 2 Parameters**, expand the **Diagnostics** tree.

When **Diagnostic Warning** is enabled, the **Output On** configuration has no effect. The output will remain active as long as one of the diagnostic warning conditions is met. The output will become inactive once it detects that there are no diagnostic warning conditions.

Service Unit

Allows the user to set up the output to toggle to active when the service timer has expired. This condition will only be held for one service timer click.

Note: This feature cannot be used if the imager is in **Continuous Read**.

When **Service Unit** is enabled, a message of up to 10 ASCII characters is sent whenever the system detects that the service timer's limit has been reached. The service timer is reset at power-on, meaning that the service timer's limit is the amount of time since last reset. Service timer increments can be set in seconds or minutes.

Output 3 Parameters

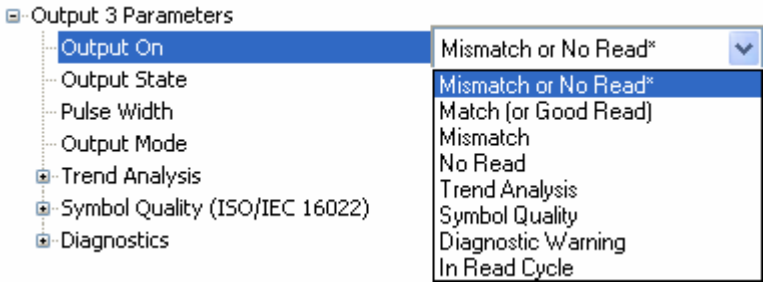
Output 3 has the same parameters and default settings as **Output 1** and **Output 2**.

Output On

Output On provides discrete signalling to host software to control external devices such as PLCs and relays. It is useful for routing, sorting, and to prevent mis-packaging and mis-routing.

Sets the discrete output functions for specific user-selected conditions. Allows the user to set the conditions under which an output (or outputs) will be activated.

Note: If **Output On** is set to **Match** or **Mismatch**, a transition (switching) will not occur unless **Matchcode Type** is enabled and a master symbol is loaded into memory.



Mismatch or No Read

Activates discrete output when the data does not match that of the master symbol or the symbol has not been decoded before the end of the read cycle.

Good Read / Match

Activates a discrete output when the symbol data matches the master symbol.

Note: To output on **Good Read** when **Matchcode** is not enabled, enable any output for **Match**.

Mismatch

Activates a discrete output whenever the symbol data does not match that of the master symbol.

No Read

Activates a discrete output whenever the symbol data is not decoded before the end of the read cycle.

Trend Analysis

Typically used when successful decodes are occurring but a discrete output is needed to flag a trend in quality issues.

Activates discrete output when a trend analysis condition is met, depending on the trend analysis option enabled.

Diagnostic Warning

Typically used when a discrete indication of a diagnostic condition is needed.

Activates discrete output when a diagnostic warning condition is met, depending on the diagnostic option enabled.

In Read Cycle

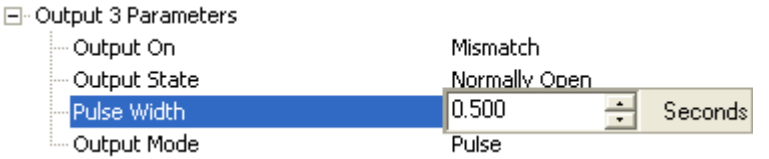
Activates a discrete output when the imager is in a read cycle.

Output State

Sets the active electrical state of the discrete output.

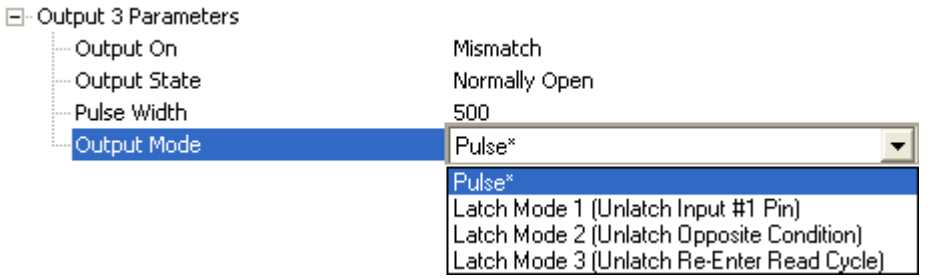
Pulse Width

Sets the time in 10 ms increments that the discrete output remains active.



Output Mode

Sets the condition in which the discrete output is de-activated.



Pulse

This is the default mode of operation in which the programmable output is activated when the **Output On** condition has been met and held active for the duration of the selected pulse width.

Latch Mode 1 (Unlatch Input # 1 Pin)

The programmable output is activated when the **Output On** condition has been met and held active until the **Input # 1 Pin**.

Note: Input 1 must be set to **Unlatch Output** for Latch Mode 1 to function.

If the Output Condition is set to **Read Cycle Data Valid**, then the read cycle will wait for Input 1 to unlatch the output before continuing on. This is to provide system handshake ability despite communication channel. The read cycle data must leave all channels before **Read Cycle Data Valid** will output.

Latch Mode 2 (Unlatch Opposite Condition)

The programmable output is activated when the **Output On** condition has been met and held active until the opposite condition selected under **Output On** has been met.

For example, if **No Read** is enabled under **Output On**, the programmable output will go active on a No Read and remain active until the opposite condition, a good read, occurs.

If the Output Condition is set to **Read Cycle Data Valid**, then the read cycle will continue but every new **Read Cycle Data Valid** event causes the output to change state to the opposite condition. This provides a toggle event per every read cycle output. The only known outout state will be the on a power-on or reset. After reading begins, the state becomes undetermined. Only the state change itself has meaning—not the absolute value.

Latch Mode 3 (Unlatch Re-enter Read Cycle)

The programmable output is activated when the **Output On** condition has been met and held active until a new read cycle begins.

Note: All of the **Output On** modes are inhibited when any **Diagnostic Warning** is active for **Output 3**.

Trend Analysis

Note: Output On under **Output 3 Parameters** must be set to **Trend Analysis** for this output to function.

Under **Output 3 Parameters**, expand the **Trend Analysis** tree.

Useful in cases where the user doesn't want to shut down for one condition but wants to monitor quality and read conditions.

Applies **Trend Analysis** settings to **Output 3**.

With **Trend Analysis**, the user can track the occurrences and frequency of mismatches, No Reads, and the number of reads per trigger, and output the results to any of three outputs.

Trend Analysis Mode = No Read

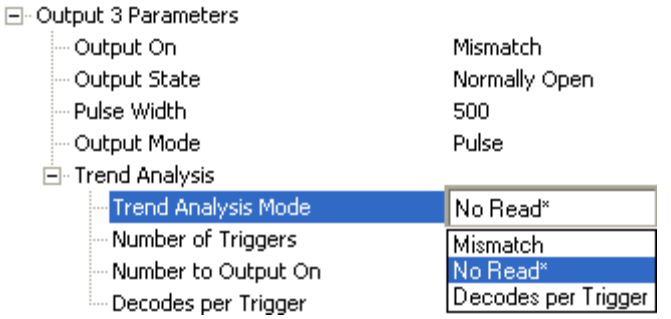
Trigger Evaluation Period = 25 triggers (read cycles)

Number to Output On = 4

In this example, the imager will activate an output when 4 No Reads occur within a period of 25 triggers (read cycles).

Trend Analysis Mode

Sets the trend condition (**Mismatch**, **No Read**, **Decodes per Trigger**, **Bad Symbol**, or **No Symbol**) that will activate the output.



Mismatch

Output will be activated when the number of mismatches equals the value entered for **Number to Output On** within the trigger window selected in **Number of Triggers**.

No Read

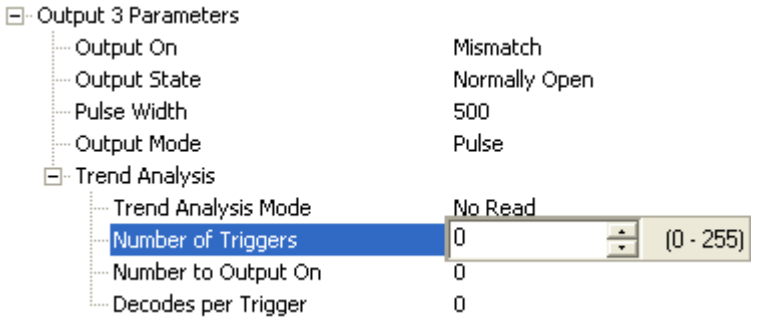
Output will be activated when the number of No Reads equals the value entered for **Number to Output On** within the trigger window selected in **Number of Triggers**.

Decodes per Trigger

Output will be activated when the number of decodes equals the value entered for **Number to Output On** within the trigger window selected in **Number of Triggers**.

Number of Triggers

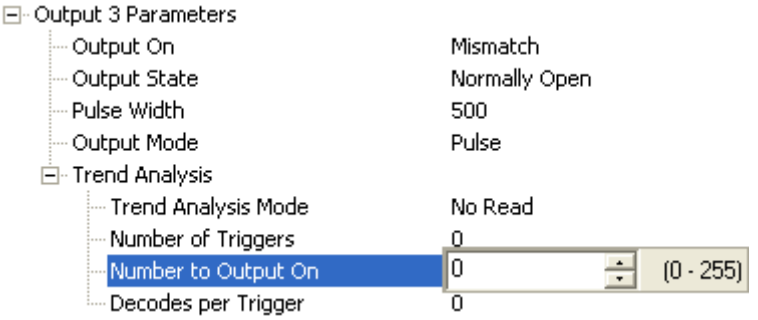
The number of triggers to examine for the trend analysis condition.



Number to Output On

Example: If **Number to Output On** is set to 3 and **Trend Analysis Mode** is set to **No Read**, then the output will not be activated until 3 No Reads have occurred.

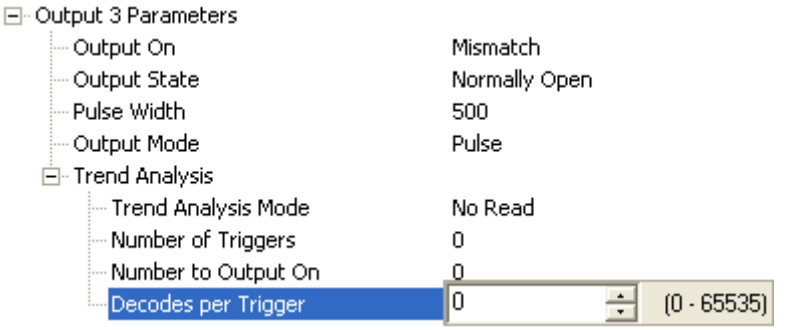
Sets the number of **Trend Analysis Mode** events (mismatches, No Reads, or reads/trigger as configured by **Trend Analysis Mode**) to occur within the trigger evaluation period before activating the associated output.



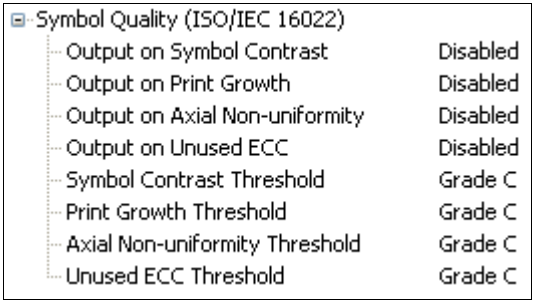
Decodes per Trigger

When set to this mode, and when the appropriate output is set to output on trend analysis, the imager will function in a **Decodes per Trigger** mode during the read cycle and the trend analysis operation. Output will be activated based on whether or not the symbol decode count at the end of the read cycle crosses the decodes per trigger threshold.

Note: Although this setup causes the imager to function in a **Decodes per Trigger** mode, the decode count will only be appended to the symbol data if the status of the **Decodes per Trigger** command is enabled.



Symbol Quality (ISO/IEC 16022)



Output on Symbol Contrast

The symbol contrast is formatted and attached to the Data Matrix symbol data as either a grade or value.

Output on Print Growth

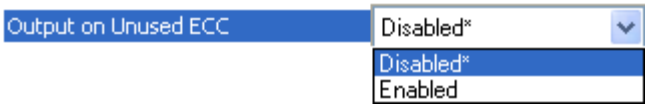
The print growth is formatted and attached to the Data Matrix symbol data as either a grade or value.

Output on Axial Non-Uniformity

The axial non-uniformity is formatted and attached to the Data Matrix symbol data as either a grade or value.

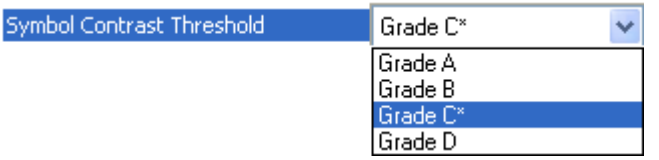
Output On Unused ECC

The unused ECC is formatted and attached to the Data Matrix symbol data as either a grade or value.



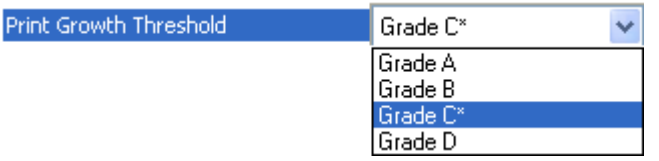
Symbol Contrast Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Symbol Contrast grade is under the threshold.



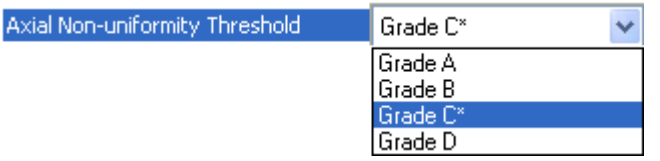
Print Growth Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Print Growth grade is under the threshold.



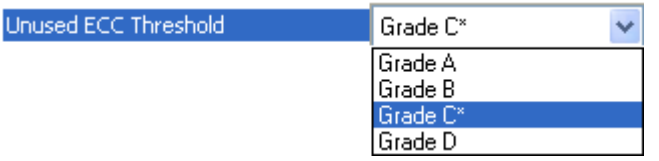
Axial Non-Uniformity Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Axial Non-Uniformity grade is under the threshold.



Unused ECC Threshold

This is the grade to use as a threshold for driving the output. Output will be driven if the Unused ECC grade is under the threshold.



Diagnostics

Note: Output On under **Output 3 Parameters** must be set to **Diagnostic Warning** for this output to function.

Under **Output 3 Parameters**, expand the **Diagnostics** tree.

When **Diagnostic Warning** is enabled, the **Output On** configuration has no effect. The output will remain active as long as one of the diagnostic warning conditions is met. The output will become inactive once it detects that there are no diagnostic warning conditions.

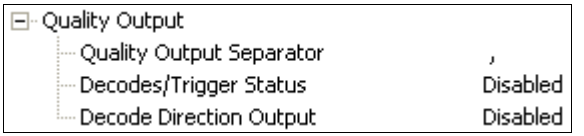
Service Unit

Allows the user to set up the output to toggle to active when the service timer has expired. This condition will only be held for one service timer click.

Note: This feature cannot be used if the imager is in **Continuous Read**.

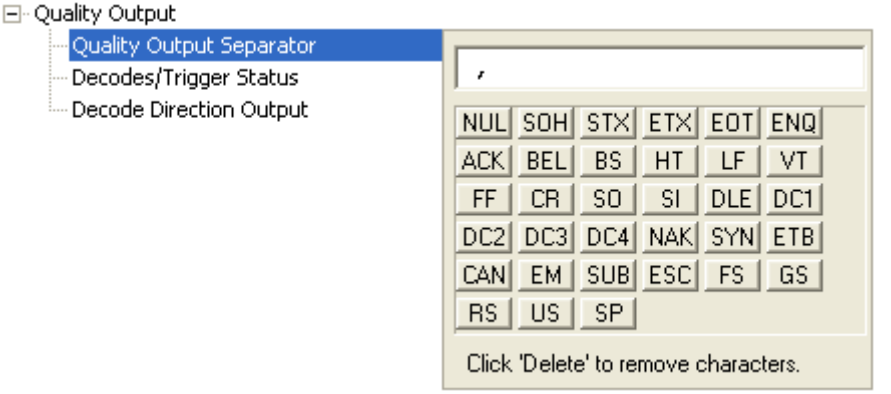
When **Service Unit** is enabled, a message of up to 10 ASCII characters is sent whenever the system detects that the service timer's limit has been reached. The service timer is reset at power-on, meaning that the service timer's limit is the amount of time since last reset. Service timer increments can be set in seconds or minutes.

Quality Output



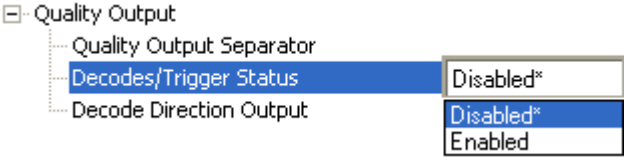
Quality Output Separator

The separator character separates quality output data from symbol data.

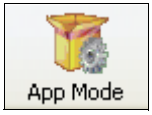


Decodes per Trigger Status

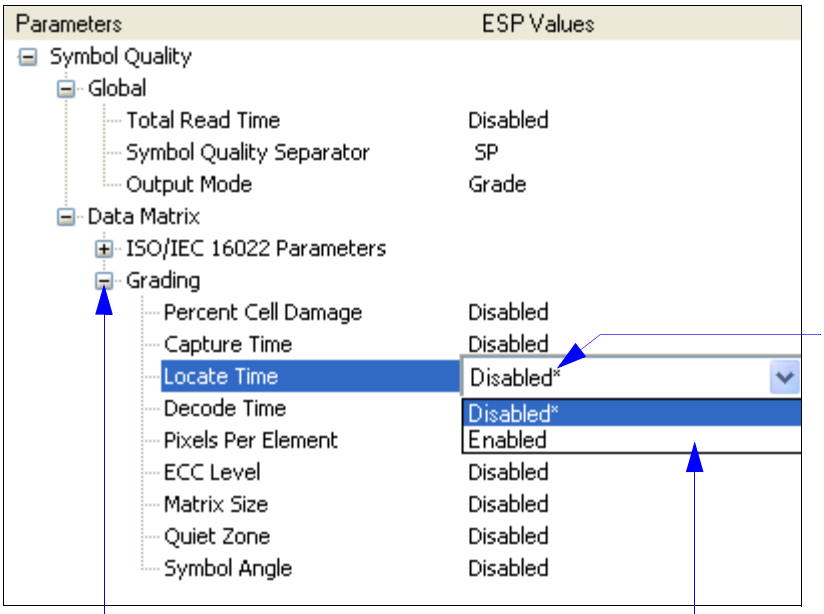
When Enabled, the imager enters a state where it processes frames as configured until the end of a read cycle, with or without a successful symbol decode. When the read cycle ends, the imager outputs any decoded symbol data along with the decodes per trigger count.



Symbol Quality



Click the **App Mode** button and then the **Parameters** button to display the tree control tabs.
Then click the **Symbol Quality** tab to display the Symbol Quality tree control.



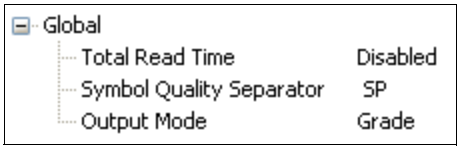
The * indicates that the setting is the default.

To open nested options, **single-click** the **+**.

To change a setting, **double-click** the setting and use the cursor to scroll through the options.

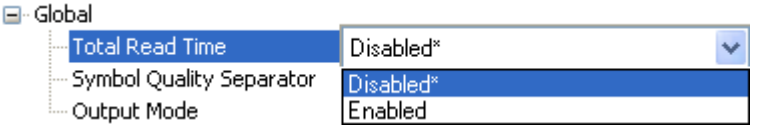
Note: Symbol Quality settings can also be sent to the imager from ESP's Terminal using Microscan's K command format.

Global



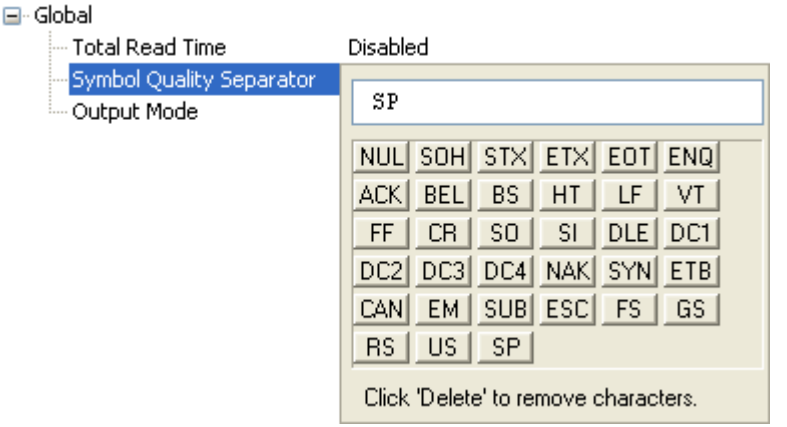
Total Read Time

When enabled, outputs the amount of time that was required by the imager to decode the symbol.



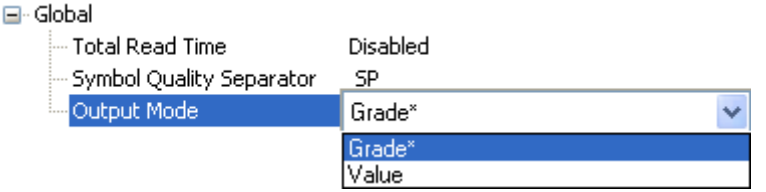
Symbol Quality Separator

This field specifies the separator used to separate the quality output data.

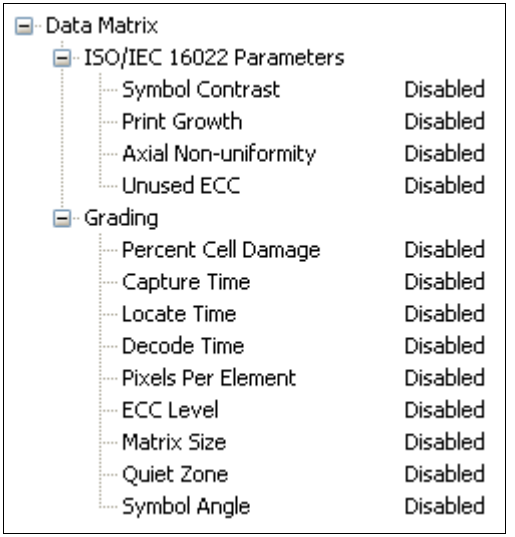


Output Mode

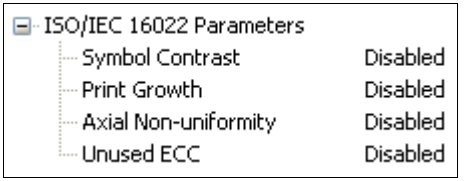
Determines how symbol quality evaluations will be output.



Data Matrix



ISO/IEC 16022 Parameters



Symbol Contrast

Outputs the candidate symbol's Symbol Contrast value.

Print Growth

Outputs the candidate symbol's Print Growth value.

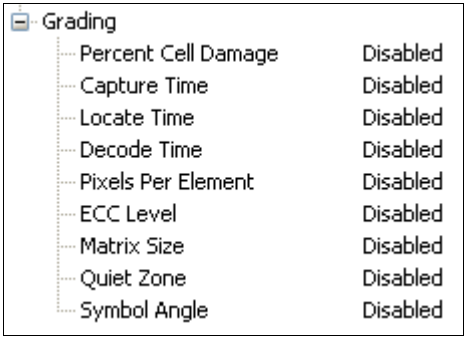
Axial Non-Uniformity

Outputs the candidate symbol's Axial Non-Uniformity value.

Unused ECC

Outputs the candidate symbol's Unused ECC value.

Grading



Percent Cell Damage

The percent of symbol cells that are damaged.

Capture Time

The amount of time the imager required to capture the area in which the symbol was located.

Locate Time

The amount of time the imager required to locate the symbol.

Decode Time

The amount of time the imager required to decode the symbol.

Pixels Per Element

The average number of pixels in a symbol element.

ECC Level

The level of error correction used when decoding the symbol.

Matrix Size

The size of the symbol's matrix area (the area composed of the symbol's elements).

Quiet Zone

The size of the quiet zone around the symbol.

Symbol Angle

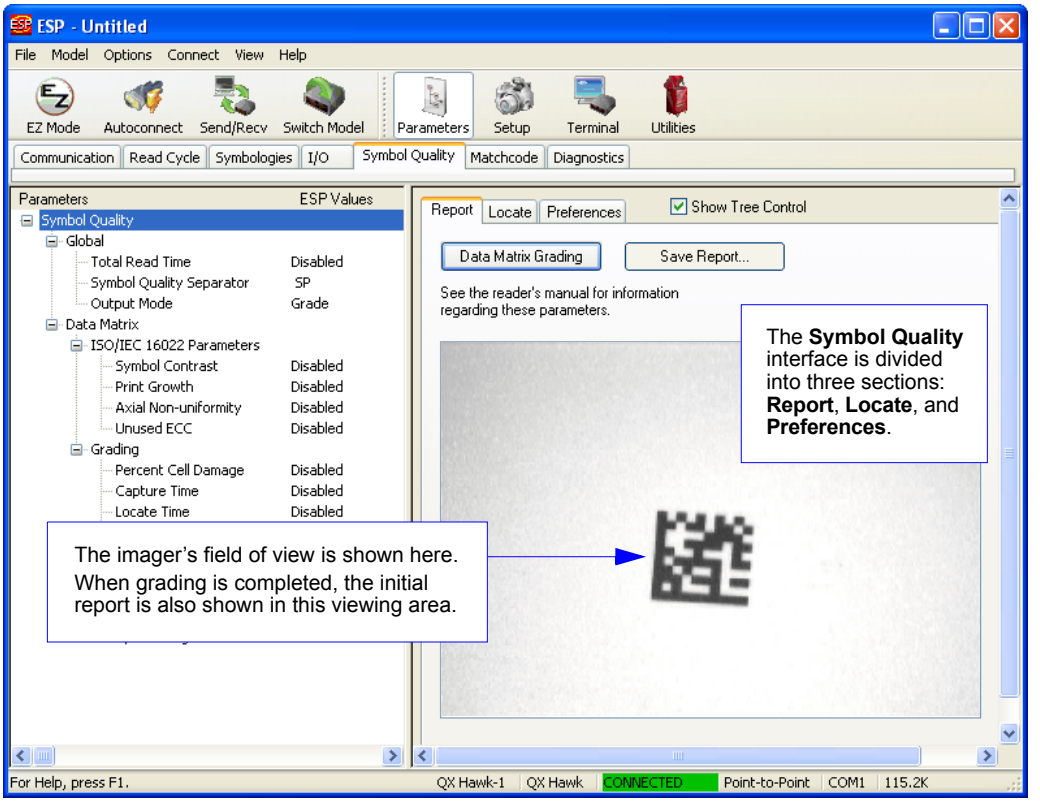
The angle at which the symbol is printed or marked.

Report Tab

The **Report** tab allows the user to initiate **Data Matrix Grading** and to generate and save grading reports.

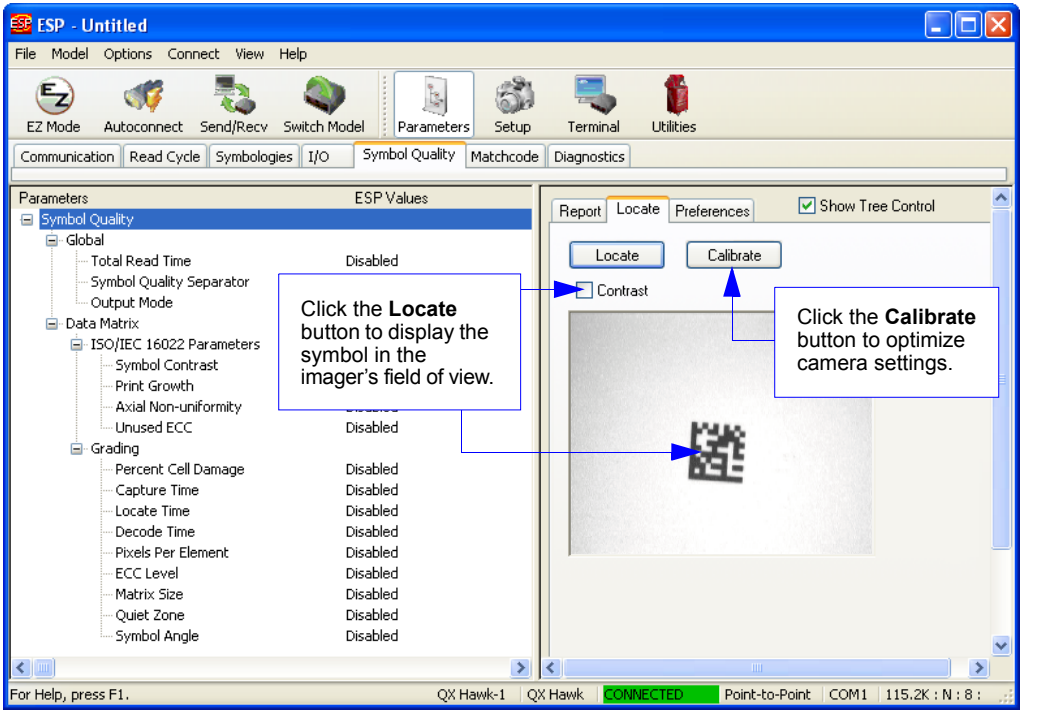
To save the report as a PDF file, an HTML file, a CSV file, or an RTF file, click the **Save Report** button.

Reports appear in the viewing area underneath the **Data Matrix Grading** and **Save Report** buttons.



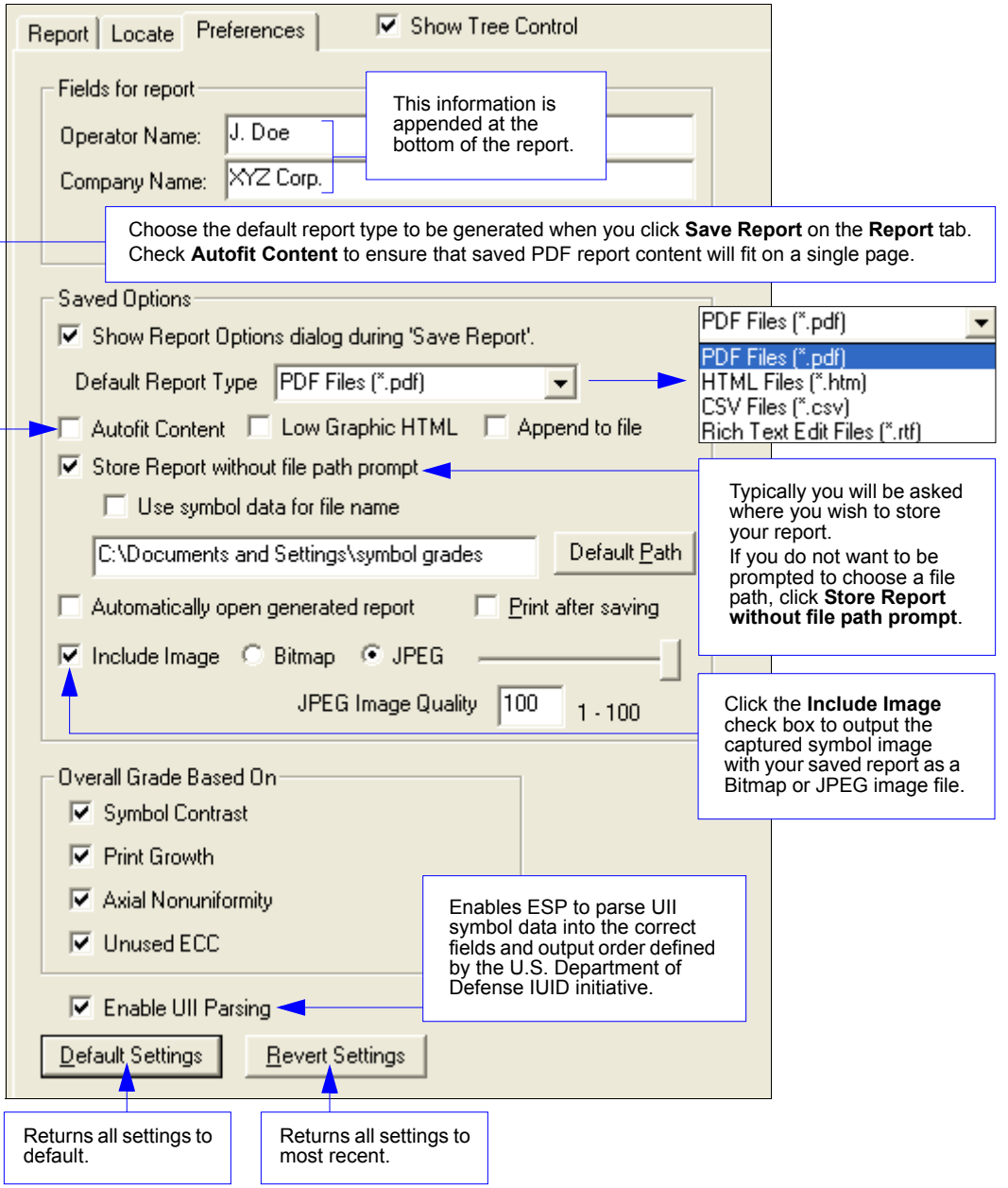
Locate Tab

The **Locate** tab allows the user to determine the position of the symbol within the imager's field of view, and to optimize the imager's camera settings for symbol quality evaluation.

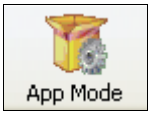


Preferences Tab

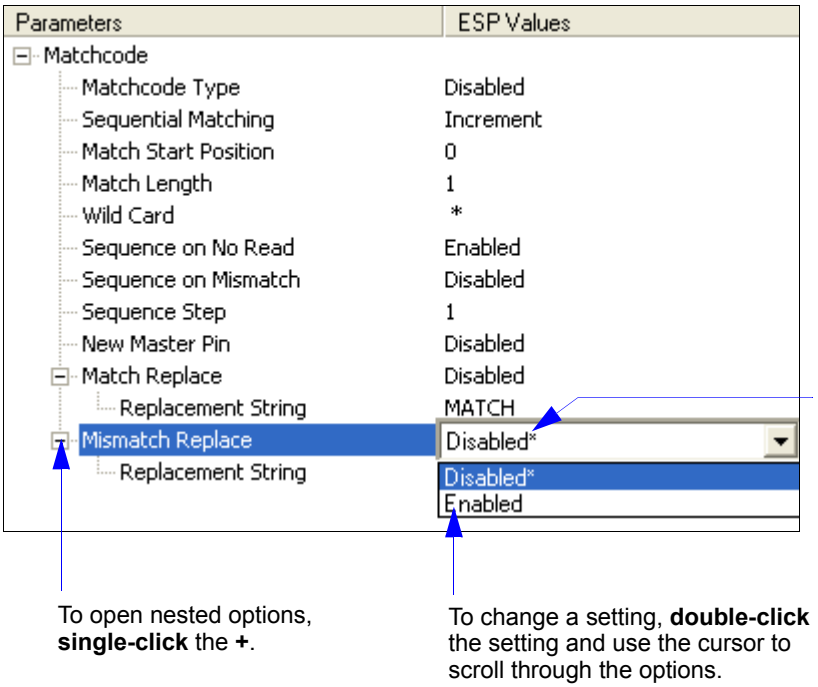
The **Preferences** tab allows the user to set defaults that are automatically activated when grading is completed. For this reason, the user is advised to set preferences before performing grading.



Matchcode



Click the **App Mode** button and then the **Parameters** button to display the tree control tabs.
Then click the **Matchcode** tab to display the Matchcode tree control.



Note: Matchcode settings can also be sent to the imager from ESP's Terminal using Microscan's K command format. Refer to the **Matchcode** section of **Appendix E**.

Overview of Matchcode

Matchcode allows the user to store master symbol data in the imager's memory, compare that data against other symbol data, and define how symbol data and/or discrete signal output will be directed.

A master symbol database can be set up for up to 10 master symbols.

Note: Matchcode will function with multiple symbols; however, if **Matchcode Type** is set to **Sequential** or if **Trigger Mode** is set to **Continuous Read 1 Output**, the imager will behave as if **Number of Symbols** were set to **1**, regardless of the user-defined configuration.

Matchcode is used in applications to sort, route, or verify data based on matching the specific symbol in a variety of ways as defined in this section. For example, a manufacturer might sort a product based on dates that are embedded in the symbol.

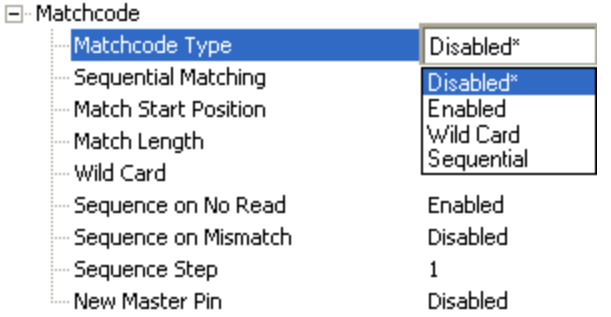
Steps for Entering and Using Master Symbols

1. Set **Trigger Mode** to **External Level**, **External Edge**, or **Serial Data**.
2. Choose the method of symbol comparison that fits the application.
3. Define the type of output required with Matchcode setup:
   a. Symbol data output
   b. Discrete output
4. Select the number of master symbols required.
5. Decide how the master symbol(s) will be entered:
   a. Use ESP to type master symbol data directly.
   b. Send a serial command with symbol data in the form of **<K231,*master symbol#, data*>**.
   c. Send a **<G>** (Read Next Symbol as Master Symbol) command.
   d. Enable the **New Master Pin** command and activate the discrete input to store the next symbol read as the master symbol.

Matchcode Type

Allows the user to choose the way that master symbols will be compared with subsequently read symbols.

Note: First set **Trigger Mode** to **External Level**, **External Edge**, or **Serial Data**.



Wild Card

Allows the user to enter user-defined wild card characters in the master symbol.

Note: If **Matchcode Type** is set to **Sequential**, the imager will behave as if **Number of Symbols** were set to **1**, regardless of the user-defined configuration.

Sequential

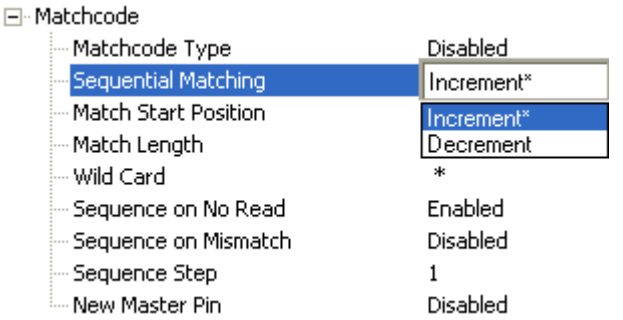
Instructs the imager to compare symbols or portions of symbols with the master symbol.

Instructs the imager to sequence after each match (numeric only) and compare symbols or portions of symbols for sequential numbers.

Sequential Matching

Useful in tracking product serial numbers that increment or decrement sequentially.

With Sequential enabled, Sequential Matching determines if a count is in ascending (incremental) or descending (decremental) order.



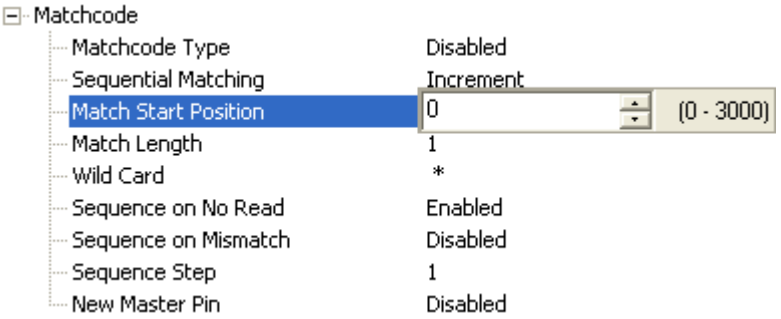
Match Start Position

Match Start Position is useful in defining specific portions of a symbol for comparison. For example, if a symbol contains a part number, manufacturing date, and lot code info, but only the part number information is needed, set the imager to sort only the part number and to ignore the other characters.

Match Start Position determines the portions of symbols that will be matched by defining the first character in the symbol (from left to right) that will be compared with those of the master symbol, when **Matchcode Type** is set to **Enabled** or **Sequential**.

For example, if **Match Start Position** is set to **3**, the first 2 characters read in the symbol will be ignored and only the 3rd and subsequent characters to the right will be compared, up to the number of characters specified by **Match Length**.

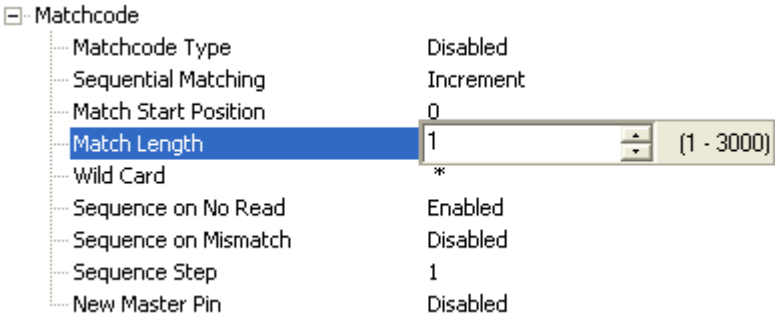
Note: Match Start Position must be set to **1** or greater to enable this feature. A **0** setting will disable this feature.



Match Length

Example: If **Match Length** is set to **6** in a 10-character symbol, and **Match Start Position** is set to **2**, only the 2nd through 7th characters (from left to right) will be compared.

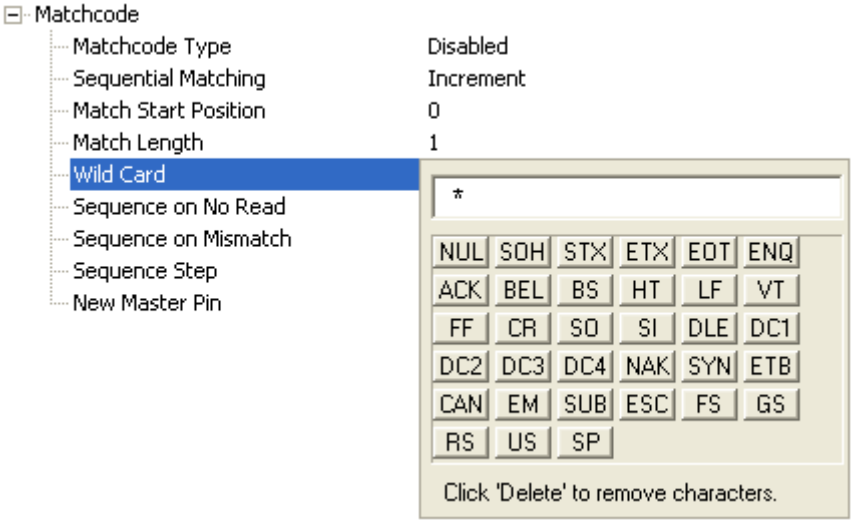
Defines the length of the character string that will be compared with that of the master symbol when **Match Start Position** is set to **1** or greater. When **Match Start Position** is set to **0**, no comparison will occur.



Wild Card

Example: With **Wild Card Character** defined as the default asterisk, defining **CR*34** as the master symbol will result in matches for CR**1**34 and CR**2**34, but not CR2345. Entering the wild card at the end of the master symbol, as in **CR***, will result in matches for variable symbol lengths such as CR**1**, CR**23**, CR**358**, etc.

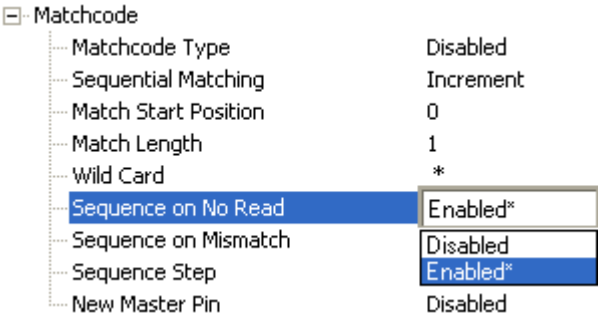
Wild Card Character allows a user to define a wild card character as part of the master symbol.



Sequence on No Read

Sequence on No Read is useful when the imager needs to stay in sequence even if no decode occurs.

When **Sequence on No Read** is **Enabled** and **Matchcode Type** is set to **Sequential**, the imager sequences the master symbol on every match or No Read. When disabled, it does not sequence on a No Read.



Consider the following decodes as an example of **Sequence on No Read Enabled**:

Master Symbol	*Decoded Symbol*	*Master Symbol after Decode*
001	001	002
002	002	003
003	No Read	004 (sequence on No Read)
004	004	005
005	No Read	006 (sequence on No Read)
006	No Read	007 (sequence on No Read)
007	007	008

Consider the following decodes as an example of **Sequence on No Read Disabled**:

Master Symbol	*Decoded Symbol*	*Master Symbol after Decode*
001	001	002
002	002	003
003	No Read	003 (not sequenced)
003	003	004
004	No Read	004 (not sequenced)
004	No Read	004 (not sequenced)
004	004	005

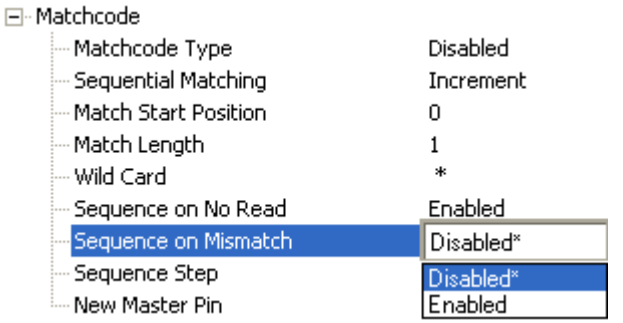
Sequence on Mismatch

Note: Matchcode Type must be set to **Sequential** for this command to function.

Enable this parameter if every trigger event should have a decode *and* more than one consecutive mismatch may occur. When set to Enabled, the master symbol sequences on every decode, match, or mismatch.

Disable this parameter if every trigger event should have a decode but no more than one consecutive mismatch may occur. When set to Disabled, the master symbol will not sequence whenever consecutive mismatches occur.

The imager will sequence the master to one more or one less than the decoded symbol.



Consider the following decodes as an example of **Sequence on Mismatch Enabled**:

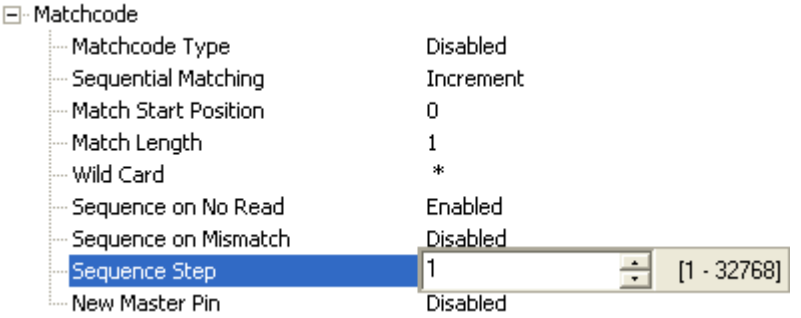
Master Symbol	*Decoded Symbol*	*Master Symbol after Decode*
001	001	002
002	002	003
003	abc	004 (sequence on mismatch)
004	004	005
005	def	006 (sequence on mismatch)
006	ghi	007 (sequence on mismatch)
007	007	008

Consider the following decodes as an example of **Sequence on Mismatch Disabled**:

Master Symbol	*Decoded Symbol*	*Master Symbol after Decode*
001	001	002
002	002	003
003	abc	004 (sequenced because of previous match)
004	004	005
005	def	006 (sequenced because of previous match)
006	ghi	006 (not sequenced)
006	006	007

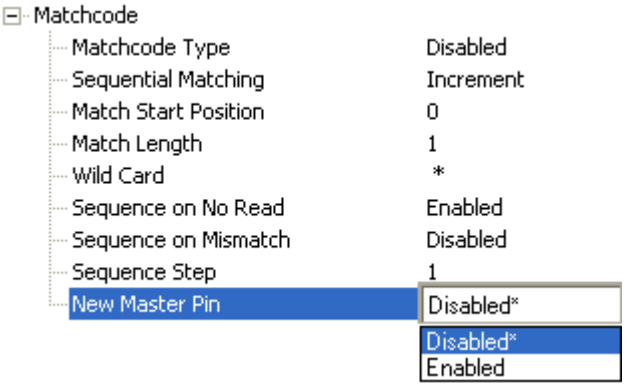
Sequence Step

When the master symbol is sequenced (incremented/decremented), **Sequence Step** defines the magnitude of change.



New Master Pin

If **Matchcode** and **New Master Pin** are enabled and the new master pin is momentarily connected to ground (must be held low for a minimum of 10 ms), master symbol information will be loaded into the database based on the next read cycle that achieves a Good Read, starting with **Index 1**. The **Master Database** will be loaded with all symbols decoded in the read cycle as long as it does not exceed the **Master Symbol Database Size** parameter.



New Master Load Status

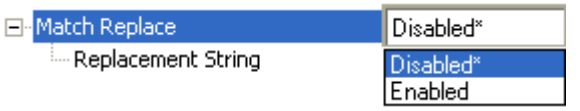
The new master status responds with the number of the next master position to be loaded, where 0 represents “idle” or “no master to be loaded.”

Example: If the user has the **Master Symbol Database Size** set to **1**, and then either sends a **<G>** or toggles an active **New Master Pin**, the state will be **1**, and prior to reading and effectively loading position **1**, the response to **<NEWM>** would be **<NEWM/1>**. Once a symbol has been read and loaded, the status will be cleared: **<NEWM/0>**.

Match Replace

Provides a convenient shortcut for applications that need to output a predefined text string whenever a symbol matches a master symbol.

Outputs a user-defined data string whenever a match occurs and **Matchcode** is enabled.



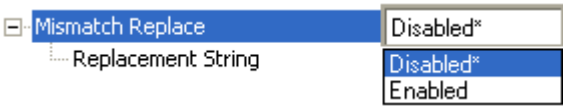
Replacement String

User-defined data string that, when enabled, replaces symbol data whenever a match occurs.

Mismatch Replace

Provides a convenient shortcut for applications that need to output a predefined text string whenever a symbol does not match a master symbol.

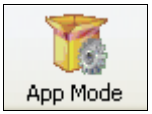
Outputs a user-defined data string whenever a mismatch occurs and **Matchcode** is enabled.



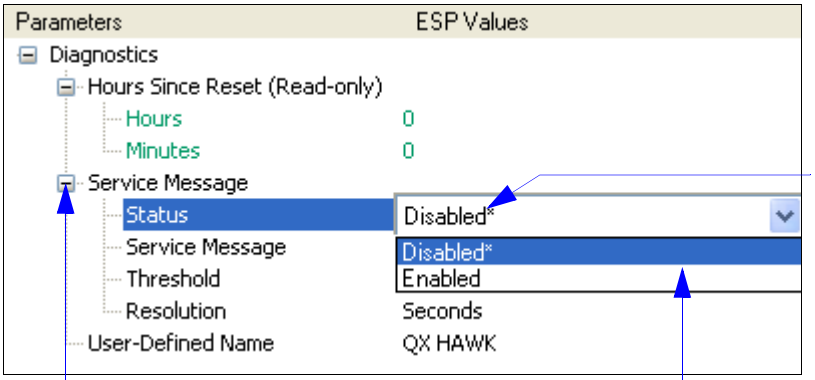
Replacement String

User-defined data string that, when enabled, replaces symbol data whenever a mismatch occurs.

Diagnostics



Click the **App Mode** button and then the **Parameters** button to display the tree control tabs.
Then click the **Diagnostics** tab to display the Diagnostics tree control.



The * indicates that the setting is the default.

To open nested options, **single-click** the **+**.

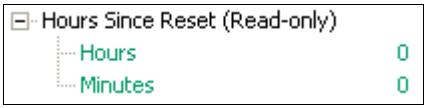
To change a setting, **double-click** the setting and use the cursor to scroll through the options.

Note: Matchcode settings can also be sent to the imager from ESP's Terminal using Microscan's K command format. Refer to the **Diagnostics** section of **Appendix E**.

Hours Since Reset (Read-only)

Used as a troubleshooting tool that can help pinpoint the cause of a reset.

Records the number of hours and minutes of operation since the last system reset.



Hours

16-bit counter that increments every 60 minutes.

Range: 0 to 23 hours.

Minutes

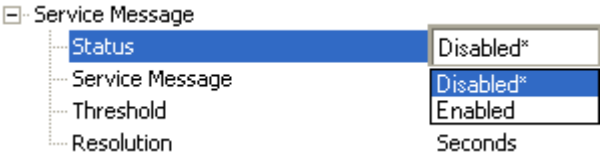
16-bit counter that increments every 60 seconds.

Range: 0 to 59 minutes.

Service Message

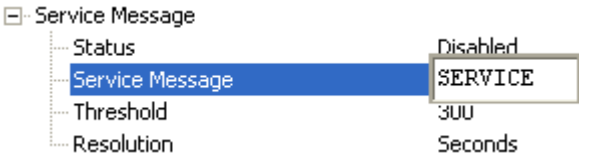
Status

When Enabled, a **Service Message** of up to 128 characters is sent whenever the system detects that the service time has expired.



Service Message

Allows the user to define a service message of up to 128 characters.

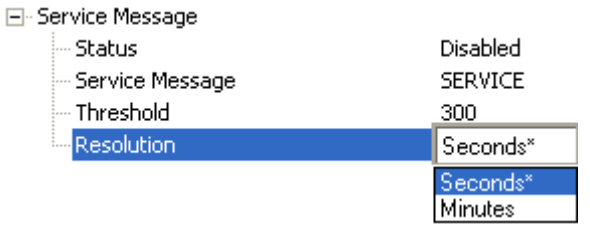


Threshold

Allows the user to determine the length of time until the service message will be sent.

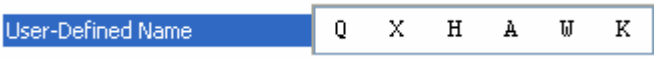
Resolution

The service timer has a resolution field for setting up the timer increment. Options are increments of seconds or minutes.



User-Defined Name

User-Defined Name allows the user to enter any combination of ASCII characters to identify the imager.



6 Terminal

Contents

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Macros 6-5
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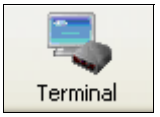
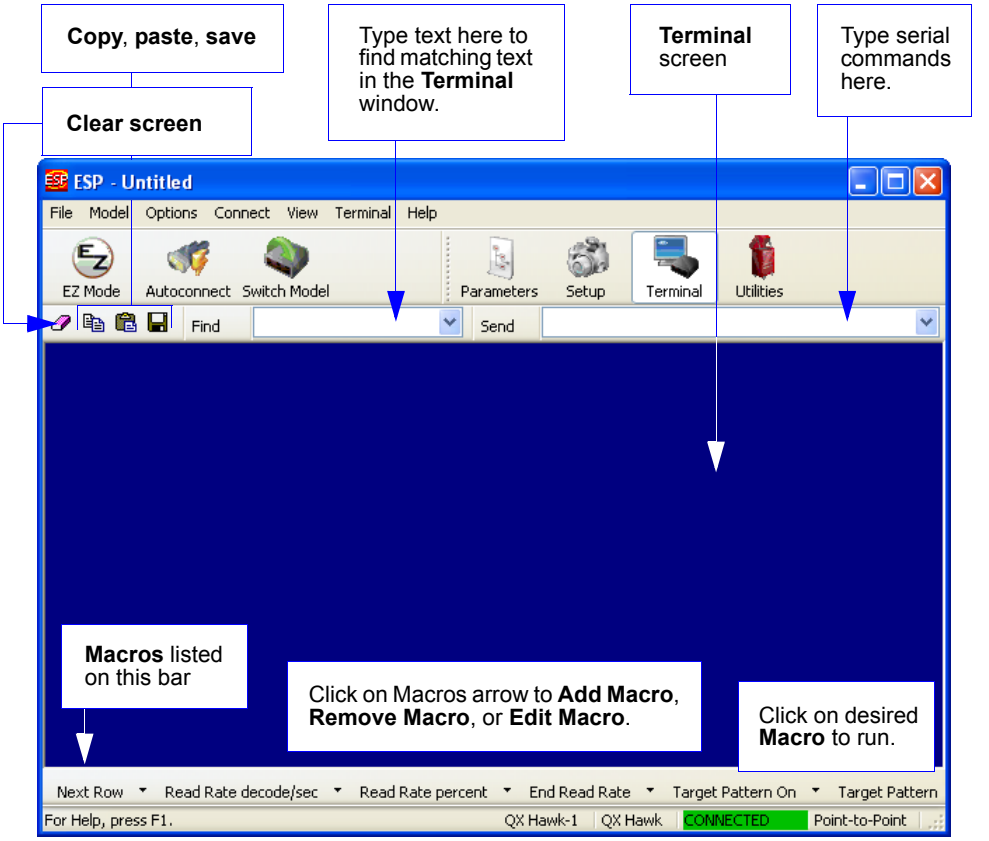
This section describes the multiple functions of ESP's **Terminal** interface.

Terminal Window



Click this button to display the **Terminal** view.



The **Terminal** interface allows the user to send serial commands to the imager by using macros, by copying and pasting, or by typing commands in the **Send** text field.

The Terminal also displays symbol data or information from the imager.

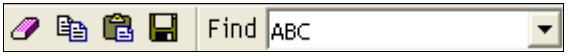
Right-clicking on the Terminal screen displays a menu of additional options.

Find

The **Find** function allows the user to enter text strings to be searched for in the Terminal.

For example:

1. Type “ABC” into the **Find** box.

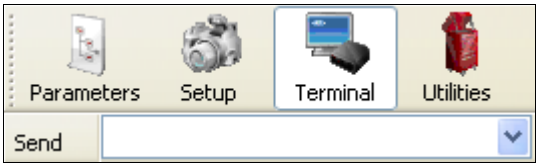


2. Press **Enter**.
   The first instance of “ABC” will be highlighted in the Terminal window.
3. Click the **Find** button to the left of the text field to locate additional instances of “ABC”.

Send

The **Send** function allows the user to enter serial commands and then send them to the imager.

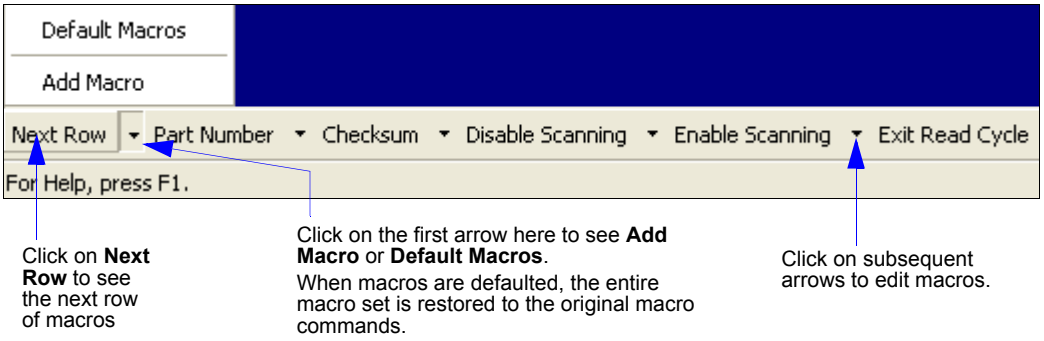
1. Type the command into the **Send** box.



2. Press **Enter**.
3. Click the **Send** button to the left of the text field to send the command additional times.

Macros

Macros can be stored in a macro selection bar, edited in a separate window, and executed by clicking on the macro name.

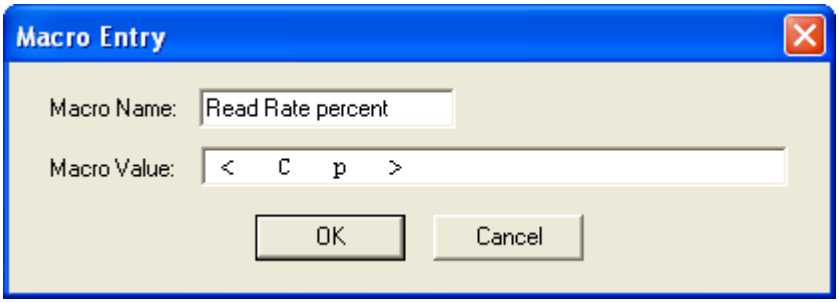


Click a macro button to execute it in the Terminal.

If the macro is a command, it is sent to the imager at the same time that it is displayed.

Editing a Macro

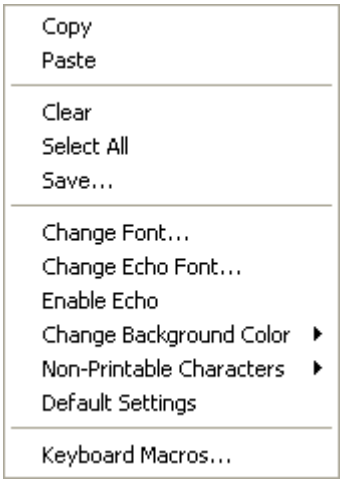
Click the arrow next to any macro and select **Edit** to display the following dialog:



Edit the macro value or type a new **Macro Name** in the text field provided and define it in the **Macro Value** field. Click **OK** to save the entry.

Terminal Window Menus

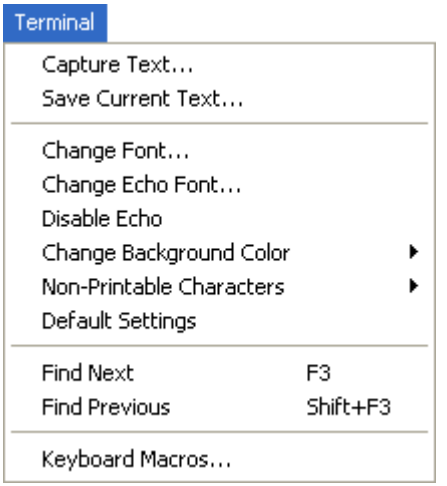
Right-click on the **Terminal** window to display the following menu:



- **Copy** selected text to clipboard.
- **Paste** from Terminal or other text.
- **Clear** all text in Terminal window.
- **Select All** text in the Terminal window.
- **Save...** brings up a **Save As** dialog.
- **Change Font...** of text in Terminal; brings up a **Font** dialog.
- **Change Echo Font...** to change typed text; brings up a **Font** dialog.
- **Enable Echo** enables Echo text (typed by user).
- **Change Background Color** of Terminal window.
- **Non-Printable Characters** allows the user to hide non-printable characters, or to show them in **Standard** or **Enhanced** format.
- **Default Settings** returns all the above settings to default.
- **Keyboard Macros** allows the user to create new keyboard macro commands that can be sent from function keys (F2, F4, F5, etc.)

Terminal Dropdown Menu

The dropdown **Terminal** menu has **Capture Text**, **Save Current Text**, **Send File**, **Find Next**, and **Find Previous** functions, as well as the same functions defined above.



- **Capture Text...** allows the user to append data in real time to a text file. While in operation, the text file cannot be opened. Pause interrupts the capture flow and Stop ends the flow and opens the file.
- **Save Current Text...** saves all text in the Terminal window to a text file.
- **Find Next** searches for a user-defined section of text in the Terminal.
- **Find Previous** operates in the same way as Find Next, but searches backward through Terminal text.

7 Utilities

Contents

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This section explains the function and purpose of serial utility commands, which are generally performed during imager operation.

Serial Utility Commands

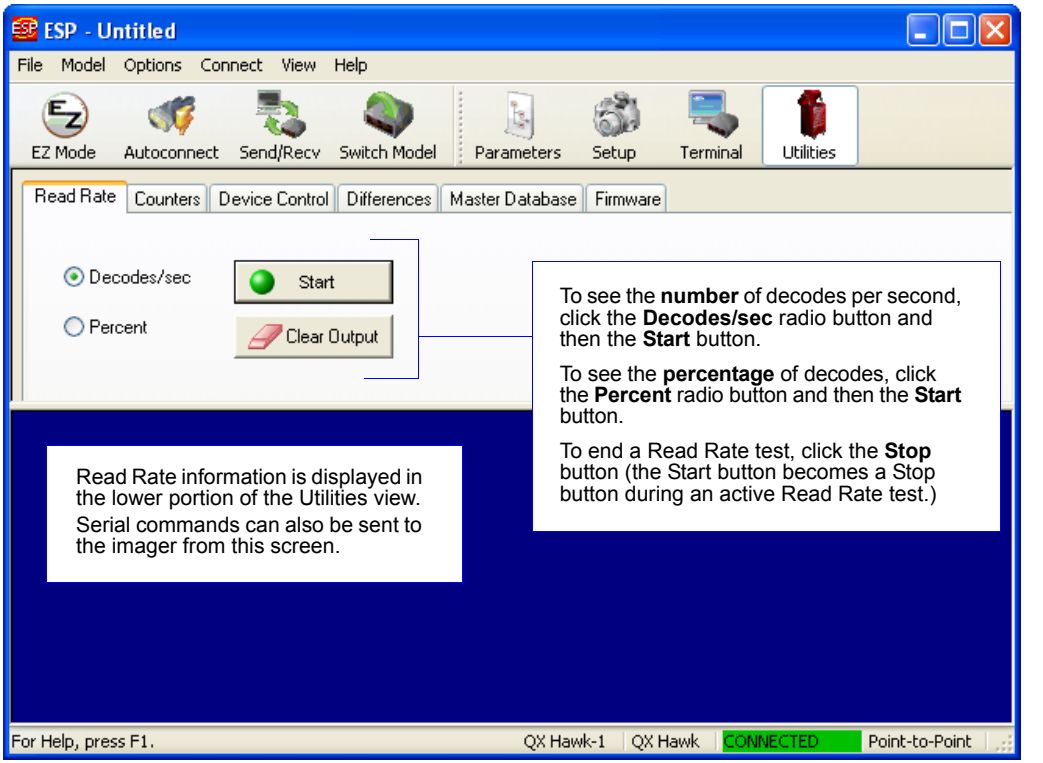
Note: For a list of all **K commands**, see **Serial Commands** on page A-12.

Type	Command	Name
Bar Code Configuration	<**BCCFG**>	Enter Bar Code Configuration
Calibration	<**@CAL**>	Calibrate
	<**@OPTIC**>	Initiate Lens Calibration
Counters	<**N**>	No Read Counter
	<**O**>	No Read Counter Reset
	<**T**>	Trigger Counter
	<**U**>	Trigger Counter Reset
	<**V**>	Good Read/Match Counter
	<**W**>	Good Read/Match Counter Reset
	<**X**>	Mismatch Counter
	<**Y**>	Mismatch Counter Reset
Default/Reset/Save	<**A**>	Software Reset – Retain Current Parameters
	<**Ard**>	Software Reset – Recall Factory Defaults
	<**Arp**>	Software Reset – Recall Power-On Defaults
	<**Arc**>	Software Reset – Recall Customer Defaults
	<**Z**>	Software Reset – Save Current Settings for Power-On
	<**Zc**>	Software Reset – Save Current Settings as Customer Defaults
	<**Zrd**>	Software Reset – Recall Factory Defaults and Save for Power-On
	<**Zrc**>	Software Reset – Recall Customer Defaults and Save for Power-On
Device Control	<**L1**>	Programmable Output 1
	<**L2**>	Programmable Output 2
	<**L3**>	Programmable Output 3
	<**I**>	Disable Imager
	<**H**>	Enable Imager
Firmware/Checksum	<**#**>	Display All Part Numbers
	<**#a**>	Display Application Code Part Number
	<**#b**>	Display Boot Code Part Number
	<**#d**>	Display DSP Code Part Number
	<**#k**>	Display Kernel Code Part Number
	<**#s**>	Display SafeMode Part Number
	<**#.**>	Display All Firmware Build Numbers
	<**#a.**>	Display Application Code Build Number

Firmware/Checksum	<**#b.**>	Display Boot Code Build Number
	<**#d.**>	Display DSP Code Build Number
	<**#k.**>	Display Kernel Code Build Number
	<**!**>	Display All Available Firmware Checksums
	<**!a**>	Display Application Code Code Checksum
	<**!d**>	Display DSP Code Checksum
	<**rb,***key*>	Roll Back Application Code
Imager Status	<**?**>	Imager Status Request
	<**K?**>	All Status Request
	<**K??**>	All Descriptor Request
	<**K?#**>	All Range Request
	<**Knnn?**>	Single Status Request
	<**Knnn??**>	Single Descriptor Request
	<**Knnn?#**>	Single Range Request
	<**Knnnd**>	Single Command Default
Learn	<**LEARN**>	Initiate Learn Operation
	<**UNLEARN**>	Initiate Unlearn Operation
	<**LEARN?**>	Display Learn Status
Master Database	<**G**>	Store Next Decoded Symbol to Database Index 1
	<**G***n*>	Store Next Decoded Symbol to Database Index *n*
	<**NEWM**>	New Master Load Status
Read Rate	<**C**>	Enter Decodes/Second Test
	<**Cp**>	Enter Decode Percent Test
	<**J**>	Exit Decodes/Second and Decode Percent Tests
Reboot System	<**reboot**>	Cold Boot System from Boot Code
Static Validation	<**VAL**>	Perform Static Validation of Data Matrix Symbol
Targeting	<**I1**>	Activate Targeting System
	<**I0**>	De-activate Targeting System
Temperature	<**@TEMP**>	Display Image Sensor Temperature
Y-Modem Transfer Options	<**uy,***path and image file name*>	Y-Modem Upload
	<**dy,***image file name*>	Y-Modem Download (Image)
	<**dy,***key*>	Y-Modem Download (Code)

Read Rate

Click the **Utilities** button and then the **Read Rate** tab to display the Read Rate view.



Important: When Read Rate is enabled, the **Configuration Database** is not active, regardless of how the imager is configured.

Read Rate Serial Utility Commands

Enter Decodes / Second Test

Sending **<C>** instructs the imager to transmit the decodes per second and symbol data (if any). The decode rate can vary dramatically due to the angle and location of the symbol in relation to the field of view. This test is very useful in aligning and positioning the imager during setup.

Enter Decode Percent Test

Sending **<Cp>** instructs the imager to transmit the percentage of decodes and any decoded symbol data.

End Decodes / Second and Decode Percent Tests

Sending **<J>** ends both the Percent test and the Decodes/Second test.

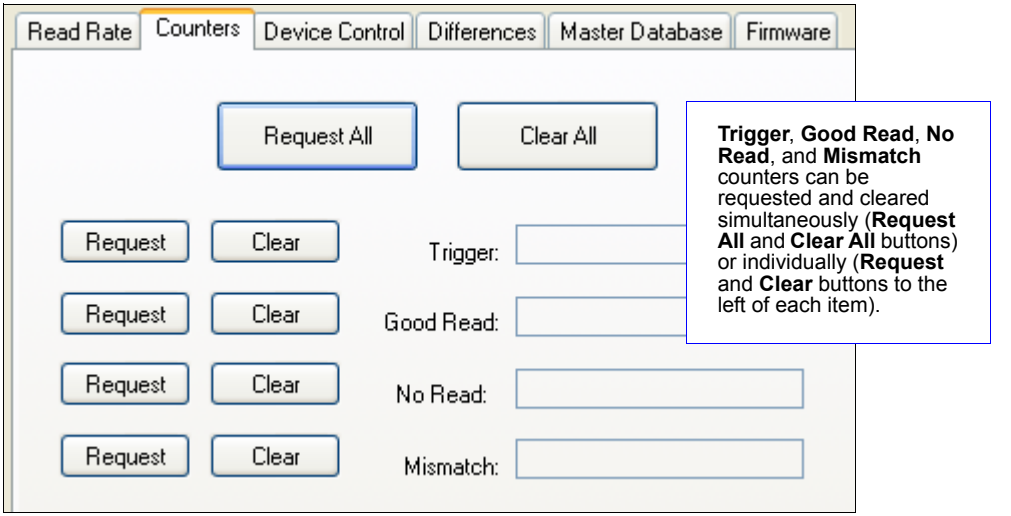
Counters

Click the **Utilities** button and then the **Counters** tab to display the Counters view.

Counter commands can be a numeric value from **00000** to **65535**. After reaching the maximum numeric limit of 65535, an error message will be displayed and the counter will automatically roll over and start counting again at 00000. To obtain the cumulative total of counts after the rollover has occurred, add 65536 per each rollover (the imager does not keep track of the number of rollovers) to the current count.

Note: All counter values will be lost if power is cycled, or if the imager receives a **Reset** or **Save** command.

Click the **Request** button to display the appropriate count or **Clear** to set the counter to zero.



Counters Serial Utility Commands

No Read Counter

Sending **<N>** displays the total number of no reads that have occurred since power-on or the last No Read Counter Reset command. A **<N/OVERF_nnn>** will be output if the counter is overflowed (**nnn** represents the number of times it has been overflowed; 255 times is the maximum). Sending **<N>** again will return the amount by which the counter has been overflowed.

Example: If the counter is at **999999999** and **3** additional counts have been captured, then **<N/ERROR>** will be output and the next **<N>** command without any new no reads will return **<N/000000003>**.

No Read Counter Reset

Sending **<O>** sets the No Read Counter to **000000000**.

Trigger Counter

Sending **<T>** displays the total number of triggers that have occurred since power-on or the last Trigger Counter Reset command. A **<T/OVERF_nnn>** will be output if the counter is overflowed (**nnn** represents the number of times it has been overflowed; 255 times is the maximum). Sending **<T>** again will return the amount by which the counter has been overflowed.

Example: If the counter is at **999999998** and **3** additional counts have been captured, then **<T/ERROR>** will be output and the next **<T>** command without any new triggers will return **<T/000000002>**.

Trigger Counter Reset

Sending **<U>** sets the Trigger Counter to **000000000**.

Good Read / Match Counter

Sending **<V>** displays either (1) the total number of decodes that match the master symbol or (2) the total number of good reads. The count begins from the last power-on or Good Read / Match Counter Reset command. To count the good reads that match the master symbol, enable Matchcode. To count good reads only, disable Matchcode. This counter is always active and can be requested at any time. A **<V/OVERF_nnn>** will be output if the counter is overflowed (**nnn** represents the number of times it has been overflowed; 255 times is the maximum). Sending **<V>** again will return the amount by which the counter has been overflowed.

Example: If the counter is at **999999997** and **3** additional counts have been captured, then **<V/ERROR>** will be output and the next **<V>** command without any new good reads or matches will return **<V/000000001>**.

Good Read / Match Counter Reset

Sending **<W>** sets the Good Read / Match Counter to **000000000**.

Mismatch Counter

Sending **<X>** displays the total number of symbols successfully decoded that do not match the master symbol since power-on or the last Mismatch Counter Reset command. A **<X/OVERF_nnn>** will be output if the counter is overflowed (**nnn** represents the number of times it has been overflowed; 255 times is the maximum). Sending **<X>** again will return the amount by which the counter has been overflowed.

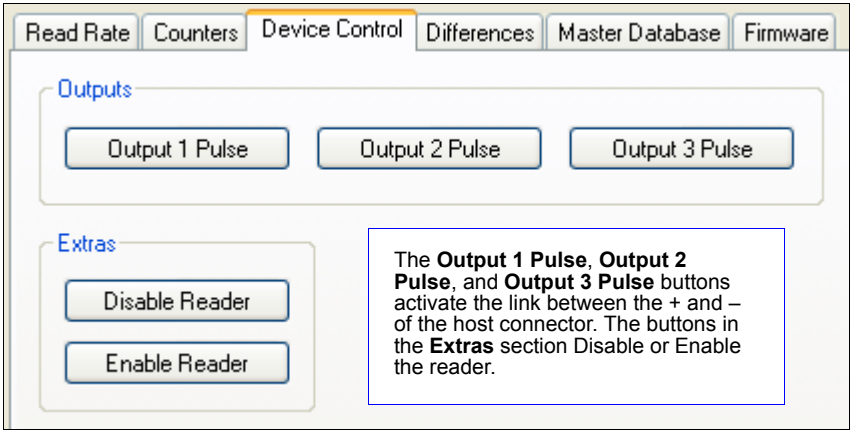
Example: If the counter is at **999999999** and **1** additional count has been captured, then **<X/ERROR>** will be output and the next **<X>** command without any new mismatches will return **<X/000000001>**.

Mismatch Counter Reset

Sending **<Y>** sets the Mismatch Counter to **000000000**.

Device Control

Click the **Utilities** button and then the **Device Control** tab to display the Device Control view.



Device Control Serial Utility Commands

Output 1 Pulse

Sending **<L1>** activates the link between Output 1 (+) and Output 1 (–) of the host connector (regardless of Master Symbol or Output 1 status).

Output 2 Pulse

Sending **<L2>** activates the link between Output 2 (+) and Output 2 (–) of the host connector (regardless of Master Symbol or Output 2 status).

Output 3 Pulse

Sending **<L3>** activates the link between Output 3 (+) and Output 3 (–) of the host connector (regardless of Master Symbol or Output 3 status).

Disable Reader

Sending **<I>** will turn the imager OFF, end the current read cycle, and will not allow the imager to enter another read cycle until turned ON. This feature is useful during extended periods of time when no symbols are being decoded, or the imager is being configured. Disabling the imager will not affect any commands that have already been downloaded.

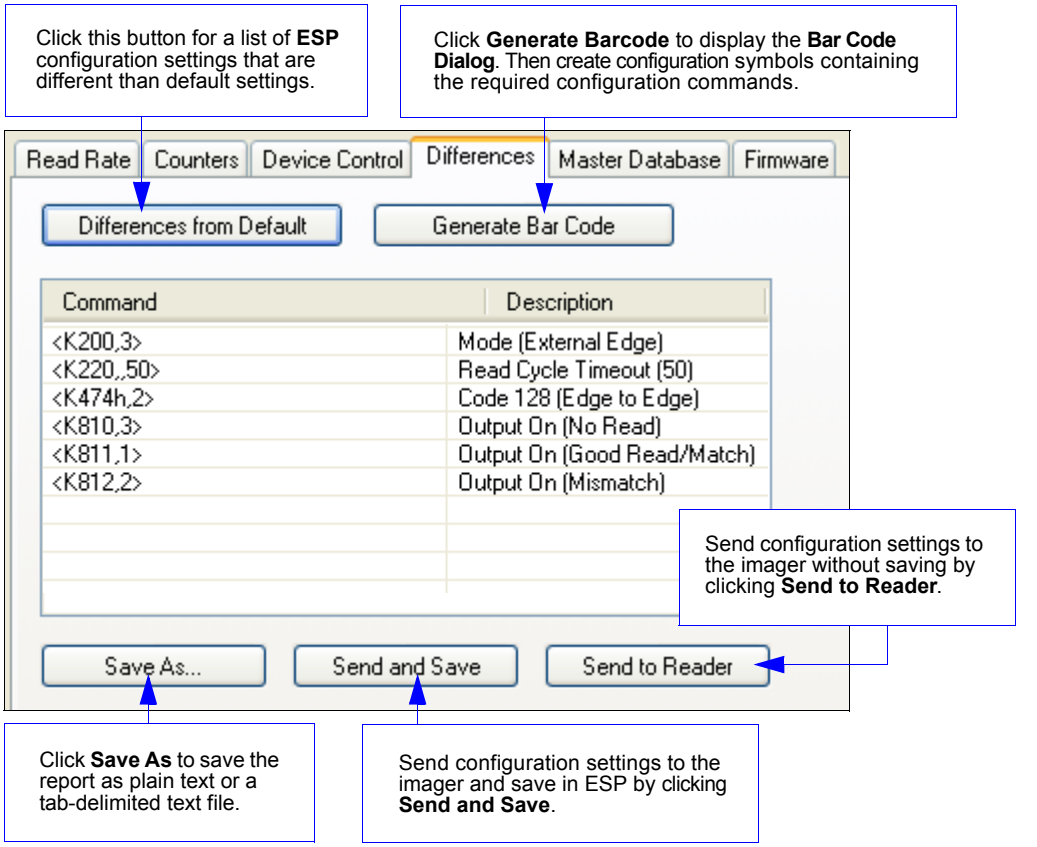
Enable Reader

Sending **<H>** will turn the imager ON and allow it to enter read cycles.

Differences from Default

Click the **Utilities** button and then the **Differences** tab to display the Differences from Default view.

Clicking the **Differences from Default** button will cause **ESP** to check all stored configuration settings and compare them to default settings. All settings that are different than default will appear in the left column (shown below), and descriptions of those settings will appear in the right column.



- To create a symbol containing any of the command settings in the table, click **Generate Barcode**.
- To save the **Differences from Default** report, either as plain text or as a tab-delimited text file, click **Save As**.
- Click **Send and Save** to send the settings to the imager and save them, or **Send to Reader** to send the settings without saving them.

  Important: To use **Differences from Default**, connect to the imager and **Receive Reader Settings** via the **Send/Recv** button on the toolbar.

Master Database

Click the **Utilities** button and then the **Master Database** tab to display the Master Database view.

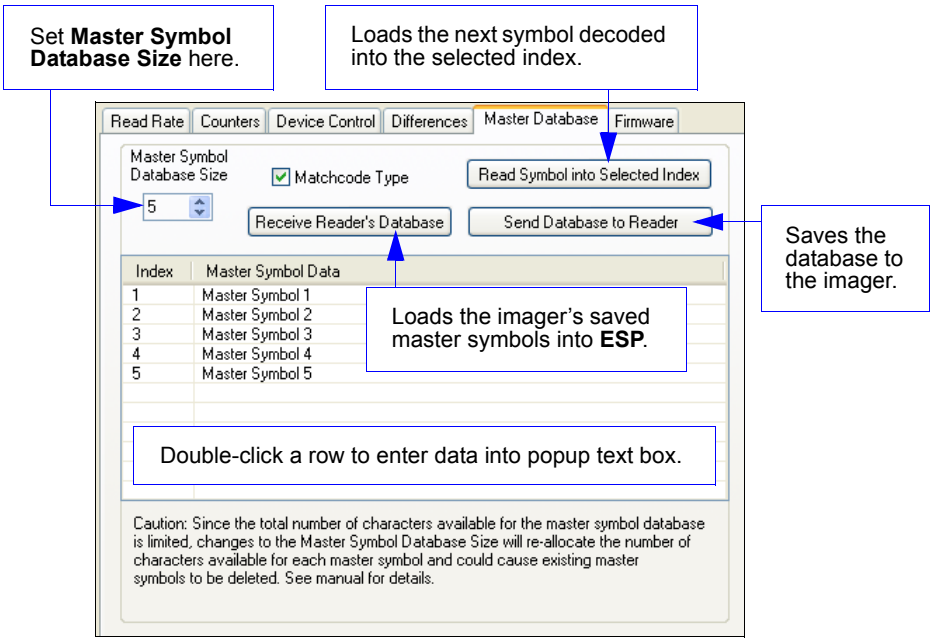
Important: The **Master Database** is used for all **Matchcode** modes except **Sequential** and **Wild Card**, both of which use **Master Database Index # 1**.

Master Database Overview

Used where more than one master symbol is required, as in a **Multisymbol** setup, for matching and other **Matchcode** operations.

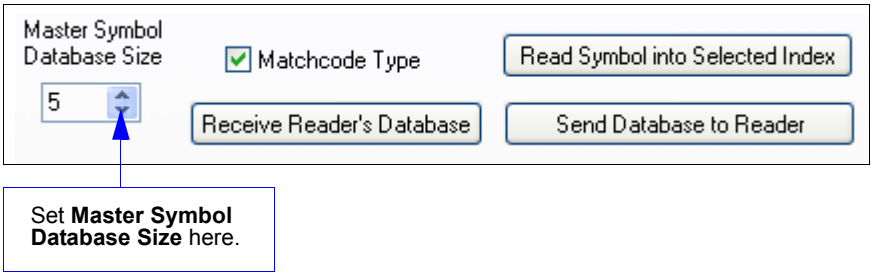
Allows the user to define up to 10 master symbols as the master symbol database, which can be entered by keyboard, scanned in, displayed, or deleted by serial or **ESP** commands.

1. Click the **Master Database** tab.
2. Enable **Matchcode Type**.
3. Set the **Master Symbol Database Size**.
4. Select the database index in which the master symbol will be entered.
5. Do one of the following to enter master symbol data:
   a. Double-click the index row to type data directly into the index.
   b. Click the **Read Symbol into Selected Index** to enter the next decoded symbol.



Master Symbol Database Size

Master Symbol Database Size allows the user to select 1 to 10 master symbols for the master symbol database.



Important: Since the total number of characters available for the master symbol database is **3000**, changes to the **Master Symbol Database Size** will re-allocate the number of characters available for each master symbol and could cause existing master symbols to be deleted (except master symbol # 1, unless it also exceeds the size limitation).

The table below specifies the maximum number of characters available to each symbol according the number of master symbols defined, from 1 to 10.

Master Symbol Number	***Maximum Characters***
# 1	3000
# 2	1500
# 3	1000
# 4	750
# 5	600
# 6	500
# 7	428
# 8	375
# 9	333
# 10	300

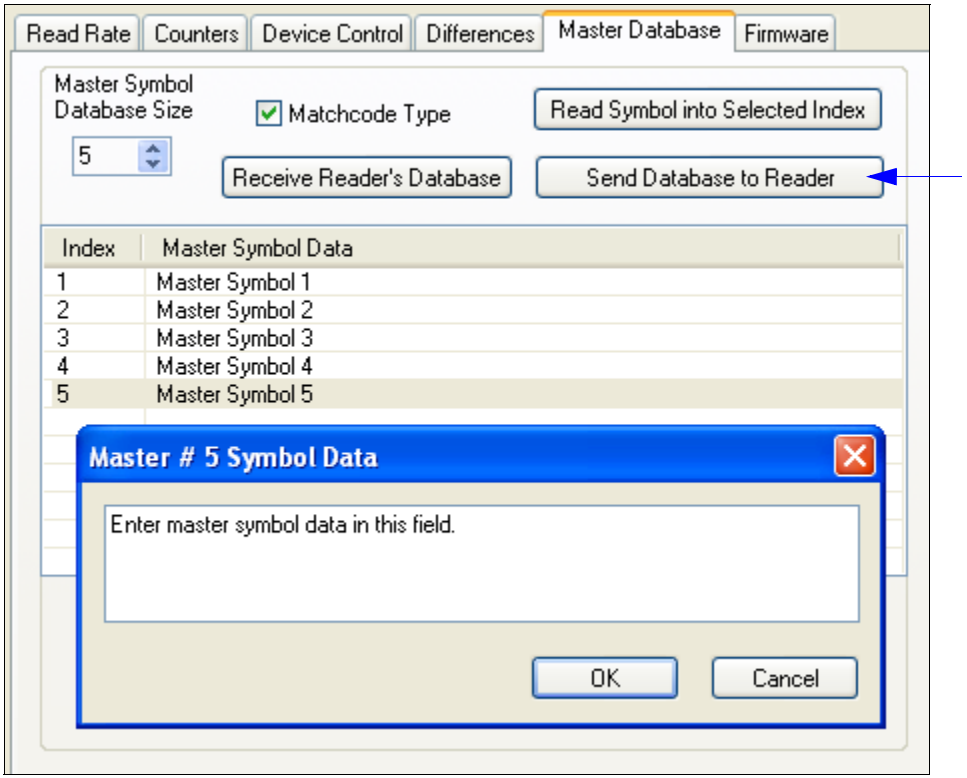
Enter Master Symbol Data

Allows the user to enter master symbol data for any enabled master symbol index number (1 to 10), provided the total number of characters does not exceed the maximum allowed.

Enter data for **1** to **10** master symbols.

Caution: If no data is entered, the existing data will be deleted.

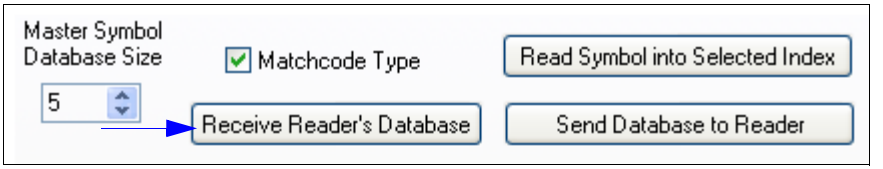
1. Open the **Utilities** menu.
2. Set the number of master symbols to be created in **Master Symbol Database Size**.
3. Double-click on each master symbol number in the table, type master symbol data in the popup dialog that appears, and click **OK**.
4. When all master symbol data has been entered, click the **Send Database to the Reader** button.



Request Master Symbol Data

Returns master symbol data for any enabled master symbols from **1** to **10**.

1. Click the **Utilities** button and the **Master Database** tab.
2. Click the **Receive Reader's Database** button.



Read Next Symbol as Master Symbol

After the size of the database is set, the imager can read the next symbol as the master symbol for any given master symbol number.

<Gmaster symbol number>

To store the next symbol decoded as master symbol # 1, send:

<G> or **<G1>**.

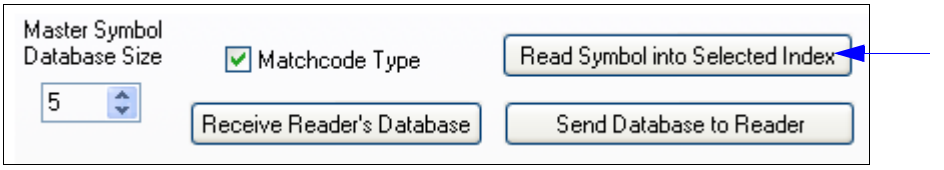
To store the next symbol decoded as the master symbol for any other master symbol database number, send:

<Gmaster symbol number [1-10]>.

For example, **<G5>** will cause the next symbol read to be entered as master symbol # 5.

In the **Master Database** tab,

1. Select the master symbol index number in which new symbol data will be stored.
2. Click the **Read Symbol into Selected Index** button.



Caution: If an index with existing data is selected, that data will be overwritten by the new decoded data when this command is used.

Request New Master Status

Informs the user when a new master symbol is pending and which position it is in.

Returns the position in the master symbol database that will be loaded on the next read.

Send the **<NEWM>** command from ESP's Terminal.

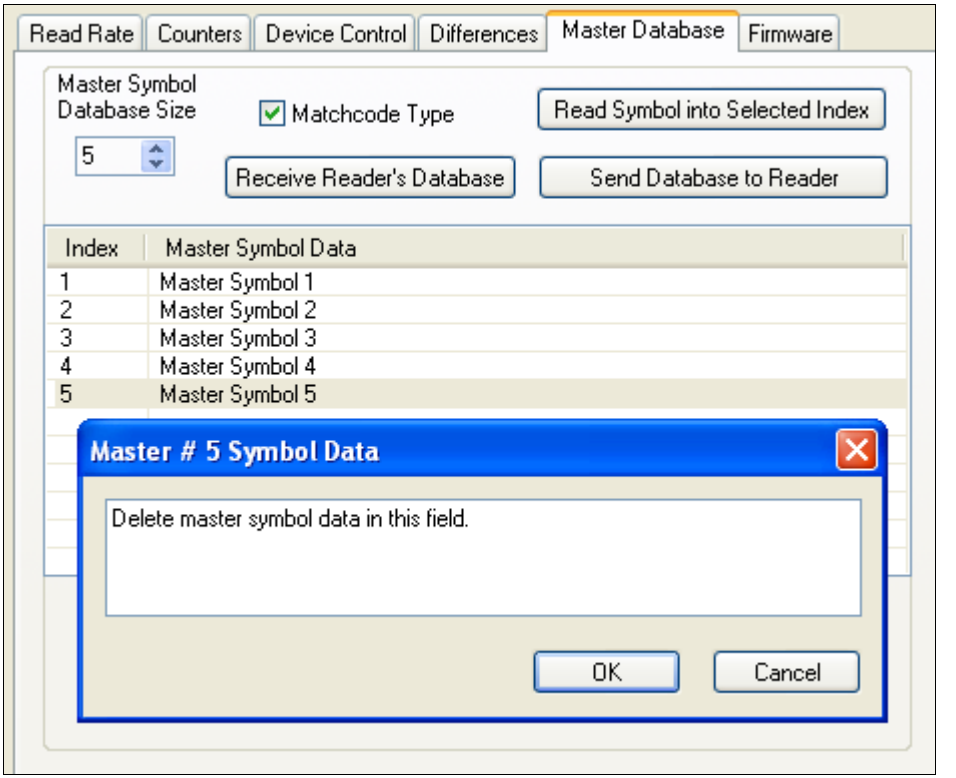
The imager returns: **<NEWM/*next master to load*>**

Once a symbol has been read and loaded, the status will be cleared and the response will be **<NEWM/0>**.

Delete Master Symbol Data

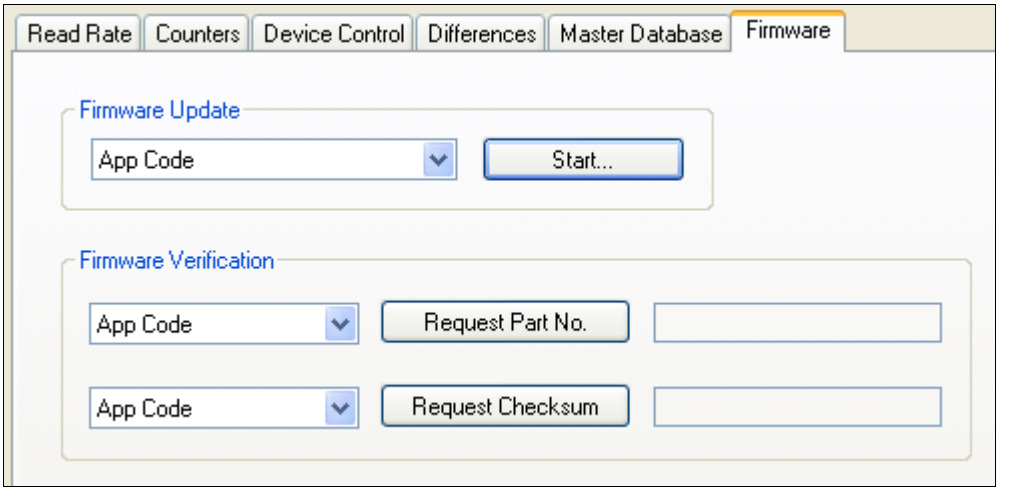
Master symbol data can be deleted using **ESP**.

1. Click the **Utilities** button to access the master symbol.
2. Click the **Master Database** tab and double-click the symbol number to be deleted.
3. Delete text and click **OK**.



Firmware

Click the **Utilities** button and then the **Firmware** tab to display the Firmware view.



Firmware Update

Firmware Update is used to download application code to the imager. Application code versions are specific to the imager. Consult with a sales representative before downloading application code. If needed, application code can be requested from Microscan.

To download application code:

1. First, be sure that the imager is connected to the host computer.
2. Apply power to the imager.
3. In the **Firmware Update** dropdown menu, select **App Code**. This will open a dialog that allows the user to browse for the application code file.
4. Navigate to where the application code file is located on the host computer.
5. Allow approximately a minute for firmware to download.

   As the application code begins to download, the imager will be silent, the LEDs will flash intermittently, and a progress indicator at the bottom of the ESP window will show when the download is complete.

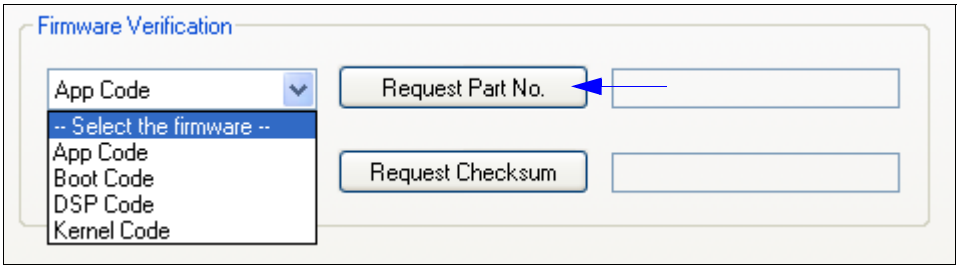
Caution: Do not interrupt power or disconnect the host cable while download is in progress.

Firmware Verification

Request Part Number

Send a request to the imager for application code, boot code, DSP code, or kernel code part numbers.

1. Click the **Firmware** tab.
2. Select App Code, Boot Code, DSP Code, or Kernel Code from the dropdown menu to the left of the **Request Part No.** button.
3. Click the **Request Part No.** button to see the part number displayed in the text field to the right.



Request Part Number by Serial Command

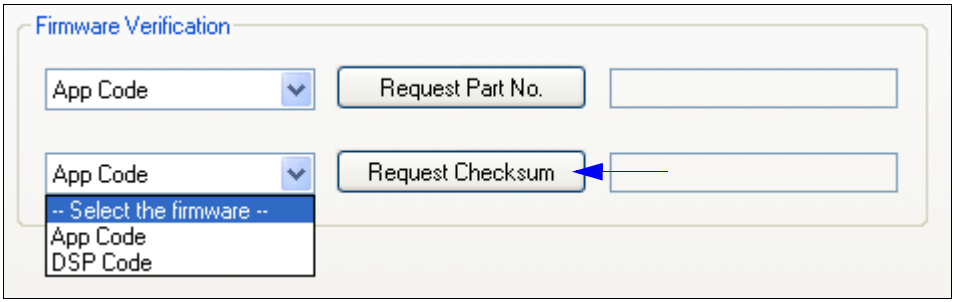
Note: X = base part number; **R** = revision number

- When **<#>** (a request for all part numbers) is sent, the imager returns: **<#a/35-XXXXXX-RR><#b/35-XXXXXX-RR><#d/35-XXXXXX-RR><#k/35-XXXXXX-RR>**.
- When **<#a>** (a request for the application code part number) is sent, the imager returns: **<#a/35-XXXXXX-RR>**.
- When **<#b>** (a request for the boot code part number) is sent, the imager returns: **<#b/35-XXXXXX-RR>**.
- When **<#d>** (a request for the DSP code part number) is sent, the imager returns: **<#d/35-XXXXXX-RR>**.
- When **<#k>** (a request for the kernel code part number) is sent, the imager returns: **<#k/35-XXXXXX-RR>**.
- When **<#s>** (a request for the SafeMode part number) is sent, the imager returns: **<#s/35-XXXXXX-RR>**

Request Checksum

Send a request to the imager for application code or DSP code checksums.

1. Click the **Firmware** tab.
2. Select App Code or DSP Code from the dropdown menu to the left of the **Request Checksum** button.
3. Click the **Request Checksum** button to see the part number displayed in the text field to the right.



Request Checksum by Serial Command

- When **<!>** (a request for all available firmware checksums) is sent, the imager returns: **<!a/APP_CHECKSUM><!d/DSP_CHECKSUM>**
- When **<!a>** (a request for the application code checksum) is sent, the imager returns: **<!a/APP_CHECKSUM>**
- When **<!d>** (a request for the DSP code checksum) is sent, the imager returns: **<!d/DSP_CHECKSUM>**

Request Build Number by Serial Command

Note: X = base part number; **R** = revision number; **B** = build number

- When **<#.>** (a request for all part numbers) is sent, the imager returns:
  <#a/35-XXXXXX-RR.BBB><#b/35-XXXXXX-RR.BBB><#d/35-XXXXXX-RR.BBB>
  <#k/35-XXXXXX-RR.BBB>.
- When **<#a.>** (a request for the application code build number) is sent, the imager returns:
  <#a/35-XXXXXX-RR.BBB>.
- When **<#b.>** (a request for the boot code build number) is sent, the imager returns:
  <#b/35-XXXXXX-RR.BBB>.
- When **<#d.>** (a request for the DSP code build number) is sent, the imager returns:
  <#d/35-XXXXXX-RR.BBB>.
- When **<#k.>** (a request for the kernel code build number) is sent, the imager returns:
  <#k/35-XXXXXX-RR.BBB>.

Bar Code Configuration Mode

Definition: **Bar Code Configuration Mode** is a way of programming the imager by using ECC 200 Data Matrix symbols.

Serial Cmd: <**BCCFG**>

Bar Code Configuration Mode can be entered three different ways:

1. By forcing the imager into **Bar Code Configuration Mode** by serial command **<BCCFG>**.
2. By configuring one of the 4 EZ Button positions to **Bar Code Configuration Mode**.
3. By reading a Data Matrix symbol with a special code word used by ISO/IEC 16022 to signify imager programming. This can be either in a regular read cycle or during a read rate test. Reading this symbol in the calibration routine will have no effect.[1]

Once **Bar Code Configuration Mode** has been entered, the Data Matrix symbols can be thought of as serial data. You can configure the imager by printing labels in Microscan's serial command format. Commands are processed as if the data were streamed in through the serial port. The imager will acknowledge the symbol with a beep, green flash, and echo the serial data to the host. If the command causes the imager to produce more serial output, such as serial verification or counter requests, the data will be routed to the host port.

Bar Code Configuration Mode can be exited by any reset **<A>** or **<Z>** command as well as a **<J>** or a quick press and release of the EZ Button.

The command to exit **Bar Code Configuration Mode** can be included as part of the Data Matrix symbol. For example, try encoding **<K200,4><K220,*1*><J>** into a Data Matrix symbol. This configures the imager to enable **Serial Trigger Mode**, to program a new trigger to end the read cycle, and to exit **Bar Code Configuration Mode** with **<J>**.

To end all EZ Button functions, press the EZ Button once and quickly release.

1. In normal reading modes, it is required to read a special Data Matrix symbol with a special codeword used by ISO/IEC 16022 to signify imager programming.

Calibration

Sending the **<@CAL>** command from ESP's Terminal initiates auto-calibration without entering the auto-calibration menu. The calibrated parameters are determined by the settings of the **Calibration Options** command.

Lens Calibration

Important: The **<@OPTIC>** command should only be used when changing the lens module.

Sending the **<@OPTIC>** command puts the imager into a setup mode for the purpose of improving the accuracy of the focal distance parameter (**<K525>**). The imager comes with a default focal curve based on unit averages. When this isn't close enough to obtain all distances, the **<@OPTIC>** command can be used to start a 2-point test to normalize the focal distance and improve accuracy. This should generally be done with lenses that were not originally shipped with the imager.

The table below shows the setting and test requirements to improve distance parameter accuracy.

Lens Type and Command	Inside Test Requirements	Outside Test Requirements
<K525,,1> (.) UHD 15°	10 mil/0.25 mm Data Matrix @ 1.0"/25 mm	30 mil/0.75 mm Data Matrix @ 10"/254 mm
<K525,,2> (..) HD 30°	10 mil/0.25 mm Data Matrix @ 1.0"/25 mm	30 mil/0.75 mm Data Matrix @ 10"/254 mm
<K525,,3> (…) SD 45°	10 mil/0.25 mm Data Matrix @ 1.0"/25 mm	30 mil/0.75 mm Data Matrix @ 10"/254 mm

Default/Reset/Save

Understanding and controlling the imager's active, saved, and default settings is critical to its successful operation.

	Function	Serial Cmd	ESP[a]	EZ Button
Resets (Not Saved for Power-On)	Reset (Will not save for power-on)	<**A**>	Save to Reader, Send No Save	No
	Reset and Recall Microscan Default Parameters	<**Ard**>	Send <**Ard**> from Terminal	No
	Reset and Recall Power-On Parameters	<**Arp**>	Send <**Arp**> from Terminal	No
	Reset and Recall Customer Default Parameters	<**Arc**>	Send <**Arc**> from Terminal	No
Saved for Power-On	Save Current Settings for Power-On	<**Z**>	Save to Reader, Send and Save	No
	Save Current Settings as Customer Default Parameters for Power-On	<**Zc**>	Save to Reader, Send and Save Customer Defaults for Power-On[b]	No
	Recall Microscan Default Settings and Save for Power-On (Will not default "sticky settings")	<**Zrd**>	Send <**Zrd**> from Terminal	No
	Recall Customer Default Settings and Save for Power-On	<**Zrc**>	Send <**Zrc**> from Terminal	Press and hold while powering on imager

a. When right-clicking in a tree control to select **Default Current Menu Settings** or **Default All ESP Settings**, it is important to note that only **ESP** settings are defaulted. To save these defaults to the imager itself, follow up with a **Save to Reader, Send and Save** command.

b. Only available in ESP if enabled in **Preferences** (**General** tab), accessible from the Options dropdown menu.

Resets

Resets ("**A**" commands) affect only the current settings (active memory) and are not saved for power-on.

Saved for Power-on

Power-on parameters ("**Z**" commands) are saved to NOVRAM and recalled and loaded into current parameters when power is cycled to the imager or the **<Arp>** command is issued.

Defaults

Defaults are Microscan firmware settings or saved customer settings that can be recalled, either by software or hardware reset.

Customer Default Parameters

Customer default parameters (saved by **<Zc>**) are the same set of parameters as power-on parameters but are saved in a different, isolated section of NOVRAM. This allows a user essentially to create a back-up set of parameters that can be recalled in the event that the current parameters or power-on parameters have been accidentally changed or are no longer desired.

It is important to note that a hardware default does not affect customer default parameters. For example, a user that has inadvertently changed communication settings and saved them with a **<Z>** command, may not know the correct settings or have the capability to communicate within those settings. By first doing an EZ Button default to restore the known Microscan defaults, the user can then recall the previous customer-saved settings with an **<Arc>** or **<Zrc>** command.

Microscan Default Parameters

Microscan default parameters are contained in the firmware and cannot be changed.

Software Defaults

Microscan default parameters can be recalled (loaded into current settings) with the **<Ard>** command or recalled and saved for power-on with the **<Zrd>** command.

Hardware Default

If a software default and reset is not possible, it may be necessary to reset the imager by shorting (connecting) specific pins. This procedure has the same effect as the **<Zrd>** software command.

Important: For this reset to occur, this command must be executed within 60 seconds of a power-on or a reset.

1. Apply power to the imager.
2. If using an IB-131, locate pins 7 and 11 on the host connector.

   Caution: Be certain that the correct pins are located. Connecting the wrong pins could cause serious damage to the unit.
3. Momentarily connect these wires (or pins) and listen for a series of short beeps.
4. Within 3 seconds, connect them again. A longer beep should be heard. If not, repeat the process.

Default on Power-On

Use the EZ Button to default the imager by holding it down while applying power to the imager (if this feature is enabled).

Imager Status

<?> Imager Status Request

The imager responds to a status request **<?>** with a two character hex value, such as **<?/22>**. To determine status:

1. Look up the binary conversion in the table below.

   For example, the first hex **2** would be **0 0 1 0** in binary, as read from binary digits **3** through **0**; the second hex **2** is also **0 0 1 0** as read from binary digits **7** through **4**.

2. Next, enter your binary values from the table below in the "Binary" column next to the appropriate bit.

Bit	Binary	Imager Status
0	0	Command error detected
1	1	Command received
2	0	Communication error detected
3	0	Flash sector unprotect failure
4	0	Host/Aux port buffer overflow
5	1	Imager is in a read cycle

3. Under "Binary," interpret **1**s as true and **0**s as not true. For example, bit 1 has a **1** in the "Binary" column, indicating "Command Received". Bit 5 is also a **1**, indicating that the "Imager is in a read cycle".

Hex Value	Binary Bit Digits 7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
3	0	0	0	0	0	0	1	1
4	0	0	0	0	0	1	0	0
5	0	0	0	0	0	1	0	1
6	0	0	0	0	0	1	1	0
7	0	0	0	0	0	1	1	1
8	0	0	0	0	1	0	0	0
9	0	0	0	0	1	0	0	1
A	0	0	0	0	1	0	1	0
B	0	0	0	0	1	0	1	1
C	0	0	0	0	1	1	0	0
D	0	0	0	0	1	1	0	1
E	0	0	0	0	1	1	1	0
F	0	0	0	0	1	1	1	1

<K?> All Status Request

This is the fastest way to learn the imager's current configuration. Sending this request will return the current settings of all commands, starting with the lowest K command value and ending with the highest K command value.

<K??> All Descriptor Request

This request will return all current descriptors for every K command, starting with the lowest K command value and ending with the highest K command value.

<K?#> All Range Request

This request will return the current settings of all commands within the user-defined range, starting with the lowest user-defined K command value and ending with the highest user-defined K command value.

<Knnn?> Single Status Request

This request will return the value of the variables associated with the requested K command. The request of a single entry of a database command cannot exceed the number of database slots for the specific command.

<Knnn??> Single Descriptor Request

This request returns the basic functional description of all fields in the requested K command.

<Knnn?#> Single Range Request

This request will return the value range and storage type description of all fields in the requested K command.

<Knnnd> Single Command Default

This request will default a single K command to original factory parameters.

Learn Operations

Learn

Sending the **<LEARN>** command from ESP's Terminal will put the imager into a mode of operation that will cause it to "learn" the next Data Matrix symbol decoded. This mode of operation will remain active until either a Data Matrix symbol is decoded or the call is made to disable the mode and revert back to normal operation. Upon decoding a Data Matrix symbol, the image processing will save pertinent information regarding the target symbol to allow it to be processed more quickly and consistently going forward.

The data collected by the Learn operation can be saved for a Power-On condition by sending the **<Z>** command.

Unlearn

Sending the **<UNLEARN>** command will cause the imager to discard any information acquired during a Learn operation.

The Unlearn state can be saved for a Power-On condition by sending the **<Z>** command.

Learn Status

Sending the **<LEARN?>** request will return the current status of Learn operations.

Responses are sent in this format:

<LEARN,0> (Default; symbol has not been learned.)

<LEARN,1> (Learn operation in progress.)

<LEARN,2> (Symbol has been learned.)

Reboot System

Sending a **<reboot>** command from ESP's Terminal will "cold-reboot" the system, starting from Boot Code.

Static Validation

Sending a **<VAL>** command from ESP's Terminal will cause the imager to perform a static validation operation and will output validation results to the Terminal.

Output Screen

Data Matrix validation information is output in the format below in response to the **<VAL>** command.

Note: If the imager fails to decode the Data Matrix symbol, a No Read message is displayed.

```
------------------------------------------------------------------------------
                            Validation Report
------------------------------------------------------------------------------
                                                                        |GRADE
                                                                        |-----
ISO/IEC     Symbol Contrast      =  60 %                                |  B
16022:      Print Growth         = -0.53    Dx   - 48 %    Dnom - 50 %  |  B
                                            Dy   - 42 %    Dmax - 65 %  |
                                                           Dmin - 35 %  |
            Axial Nonuniformity  =  0.02    Xavg - 4.7                  |  A
                                            Yavg - 4.6                  |
            Unused ECC           =  34 %    Eact -   8                  |  D
                                            Emax -  12                  |
GRADING:    % Cell Damage        =   2 %                                |
            Total Read Time      =  30 ms                               |
            Capture Time         =  17 ms                               |
            Locate Time          =  10 ms                               |
            Decode Time          =   3 ms                               |
            Pixels/Element       =  4.6                                 |
            ECC Level            = 200                                  |
            Matrix Size          = 16x16                                |
            Quiet Zone           = PASS                                 |
SYMBOL
DATA:       CI99000000000001834214
```

Validation Parameters

Symbol Contrast

Usage: Lets the user know if contrast settings are less than acceptable.

Definition: All the pixels that fall within the area of the test symbol, including its required zone, will be sorted by their reflectance values to select the darkest 10% and the lightest 10% of the pixels. The arithmetic mean of the darkest and the lightest pixels is calculated and the difference of the two means is the Symbol Contrast.

(ANSI) Symbol Contrast grading is defined this way:

A (4.0) if SC ≥ 70%
B (3.0) if SC ≥ 55%
C (2.0) if SC ≥ 40%
D (1.0) if SC ≥ 20%
F (0.0) if SC ≤ 20%

Print Growth

Definition: The extent to which dark or light markings appropriately fill or exceed their module boundaries. These values are determined by counting pixels in the clock pattern of the binary digitized image, then comparing it to a nominal value and minimum and maximum values. The grade is defined in this way:

A (4.0) if -.050 ≤ PG ≤ 0.50
B (3.0) if -.070 ≤ PG ≤ 0.70
C (2.0) if -.085 ≤ PG ≤ 0.85
D (1.0) if -.100 ≤ PG ≤ 1.00
F (0.0) if PG < -1.00 or PG > 1.00

Axial Non-Uniformity (Data Matrix Only)

Definition: Axial non-uniformity is a measure of how much the sampling point spacing differs from one axis to another, namely

AN = abs (XAVG - YAVG) / ((XAVG + YAVG)/2)

where abs ( ) yields the absolute value. If a symbology has more than two major axes, then AN is computed for those two average spacings which differ the most. The grade is defined in this way:

A (4.0) if AN ≤ .06
B (2.0) if AN ≤ .08
C (2.0) if AN ≤ .10
D (1.0) if AN ≤ .12
F (0.0) if AN ≥ .12

Unused Error Correction (Data Matrix Only)

Definition: The correction capacity of Reed-Solomon decoding is expressed in the equation:

e + 2d ≤ d - p

where **e** is the number of erasures, **t** is the number of errors, **d** is the number of error correction codewords, and **p** is the number of codewords reserved for error detection.

The Unused Error Correction parameter tests the extent to which regional or spot damage in the symbol has eroded the decoding safety margin that error correction provides. The grade is defined in this way:

A (4.0) if UEC ≥ .62
B (3.0) if UEC ≥ .50
C (2.0) if UEC ≥ .37
D (1.0) if UEC ≥ .25
F (0.0) if UEC ≤ .25

Targeting

Activate Targeting System

Sending a **<l1>** command (lower-case L and numeral 1) from ESP's Terminal activates the imager's targeting system.

De-activate Targeting System

Sending a **<l0>** command (lower-case L and numeral 0) de-activates the imager's targeting system.

Temperature

Sending a **<@TEMP>** command from ESP's Terminal will cause the imager to output the current temperature of the image sensor in degrees celsius. The output from this command is only updated after an image frame has been captured. If the command is requested but an image has not been captured, the previous temperature output value will remain the same.

Output Example:

Command	Response
<@TEMP>	<TEMP/30.50c>

Y-Modem Transfer Options

Y-Modem Upload

<**uy,***path and image file name*>

Note: There are only three scales available from the imager. The three scales are full, quarter, and eighth. The Directory response will read out the image dimensions. To receive the image, request to download by the reported dimensions. If quarter-scaled or eighth-scaled images are required, then divide the dimensions by 4 or by 8 and request by the reduced dimensions.

(1.) Directory
(None assumes root)
/ (Root Directory)
/saved (Saved Directory)

(2.) Image Status
Good/ (IP decoded a symbol)
No Read/ (IP did not decode a symbol)
Mismatch/ (IP decoded the wrong symbol)
Pending/ (Not run through IP)

(3.) Age
0 to n
n = Max Images (8 ≤ Max)

(4.) Image Name (Full-Scale)
1280 x 1024.bmp
1280 x 1024_gs.bmp
1280 x 1024.jpg
1280 x 1024_q(1-100).jpg
Valid Scales (Depends on Full Dimensions)
1280 x 1024 (Full)
320 x 256 (Quarter - divide by 4)
160 x 128 (Eighth - divide by 8)

(5.) Type
.bmp (Bitmap image - no loss of resolution)
.jpg (JPEG image - loss of resolution with compression)
JPEG Compression Quality (1-100%)
_q1.jpg
_q100.jpg

Examples: <uy,/saved/noread/2/320x256_gs.bmp> <uy,/saved/noread/2/320x256_q33.jpg>

Y-Modem Download (Code)

<**dy,***key*>

Key
app.bin
dsp.bin
ker.bin

Note: The “key” field only accepts app.bin, dsp.bin, or ker.bin.

Appendices

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Appendix A — General Specifications

Mechanical
Height: 1.59" (40.5 mm)
Width: 2.27" (57.6 mm)
Depth: 3.79" (96.3 mm)
Weight: 10 oz. (280 g)

Environmental
Enclosure: Die-cast aluminum, IP65/67 rated
Operating Temperature: 0° to 50° C (32° to 122° F)
Storage Temperature: –40° to 70° C (–40° to 158° F)
Humidity: up to 90% (non-condensing)

Communication Interface
Standard Interfaces: RS-232, RS-422, RS-485, Ethernet

CE Mark
General Immunity for Light Industry: EN 55024:1998 ITE Immunity Standard
Radiated and Conducted Emissions of ITE Equipment: EN 55022:98 ITE Disturbances

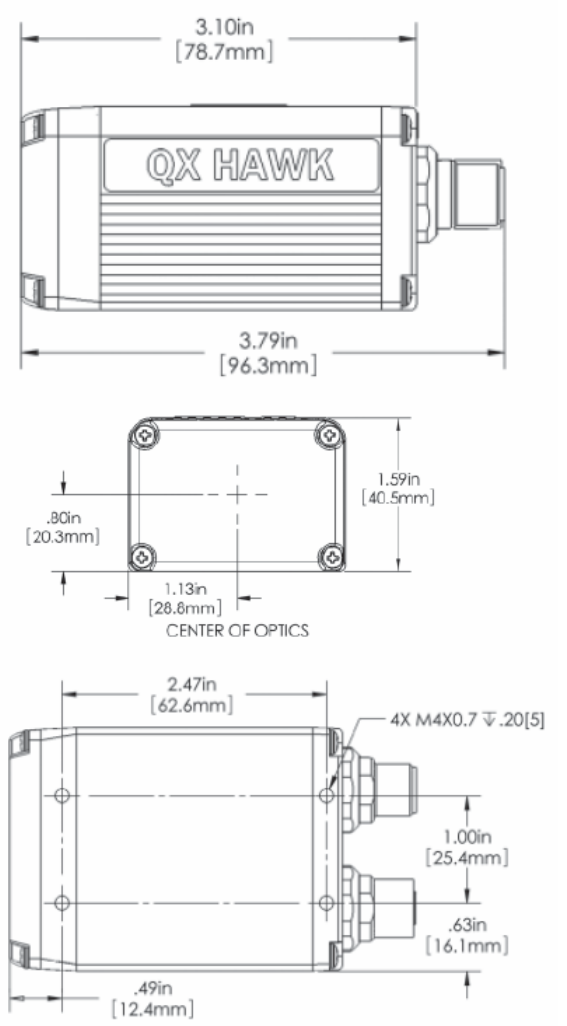
Light Source
Type: High-output LEDs

WARNING
LED LIGHT
DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS
CLASS 1 LED PRODUCT
Light Output: .564 mW. Wavelength: 470, 525, 617 nm.
IEC 60825-1:1993+A1:1997+A2:2001

Light Collection Options
Progressive scan, square pixel.
Shutter: Software-adjustable 1/60 to 1/40,000
WVGA: 752 x 480 pixels

Symbologies
2D Symbologies: Data Matrix (ECC 0-200), QR Code, Micro QR Code
Stacked Symbologies: PDF417, MicroPDF417, GS1 DataBar (Composite and Stacked)
Linear Symbologies: Code 39, Code 128, BC412, Interleaved 2 of 5, UCP/EAN, Codabar, Code 93

Read Parameters
Pitch: ±30°
Skew: ±30°
Tilt: ±360°
Decode Rate: Up to 60 decodes per second
Focal Range: 1" (33 mm) to ∞ (liquid lens autofocus) **Note:** Ranges correspond to specific symbol element sizes, and range increases as element size increases.



QX Hawk Dimensions

Indicators
LEDs: Read Performance, Power, Read Status
Green Flash: Good Read
Red X: Symbol Locator
Beeper: Good Read, Match/Mismatch, No Read, Serial Command Confirmation, On/Off

Electrical
Power Requirement: 5-28VDC

Discrete I/O
Input 1 (Trigger/New Master): Optoisolated, 4.5–28V rated (13 mA at 24VDC); New Master is (–) to signal ground
Outputs (1, 2, 3): Optoisolated, 1–28V rated (I_{CE} < 100 mA at 24VDC, current limited by user)

Safety Certifications
CDRH, FCC, CE, CB, BDMI (compliant)

RoHS/WEEE Compliant

ISO Certification
ISO 9001 Certified
Issued by TüV USA

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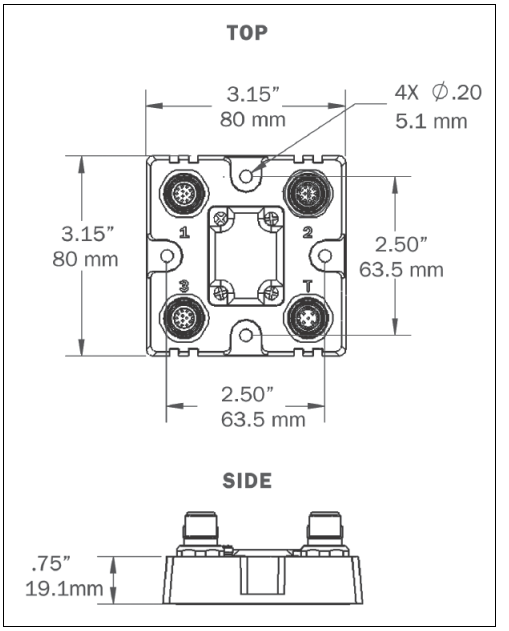
All rights reserved. Specifications subject to change.
Product specifications are given for typical performance at 25°C (77°F) using grade A labels. Performance characteristics may vary at high temperatures or other environmental extremes. Warranty–One year limited warranty on parts and labor. Extended warranty available.

QX-1 Interface Device

Mechanical
Height: .75" (19.1 mm)
Width: 2.50" (83.5 mm)
Depth: 3.15" (80 mm)
Weight: 7 oz. (200 g)



QX-1 Dimensions

Read Ranges

Modular Zoom Optics: inches (mm)

	Narrow Bar Width		Read Range	Field of View		Depth of Field	
	1D	**2D**	**(using autofocus)**	**Inside Edge**	**Outside Edge**	**Inside Edge**	**Outside Edge**
15°	0.0033 (0.08)	0.005 (0.13)	1 to 6 (25 to 152)	0.53 (13)	1.8 (46)	0.2 (5)	0.8 (20)
	0.0075 (0.19)	0.010 (0.25)	1 to 14 (25 to 356)	0.53 (13)	3.5 (89)	0.8 (20)	2.5 (64)
	0.015 (0.38)	0.020 (0.51)	2 to 29 (51 to 737)	0.53 (13)	7.5 (191)	1.5 (38)	9 (229)
	0.035 (0.89)	0.050 (1.27)	3 to 60 (76 to 1,524)	1.03 (26)	15.5 (394)	7 (178)	50 (1,270)
30°	0.0033 (0.08)	0.005 (0.13)	1 to 3 (25 to 76)	0.83 (21)	1.8 (46)	0.4 (10)	0.8 (20)
	0.0075 (0.19)	0.010 (0.25)	1 to 6.5 (25 to 165)	0.83 (21)	3.5 (89)	0.8 (20)	1.8 (46)
	0.015 (0.38)	0.020 (0.51)	1 to 16 (25 to 406)	0.83 (21)	8.3 (211)	2 (51)	8.5 (216)
	0.035 (0.89)	0.050 (1.27)	2 to 32 (51 to 813)	1.3 (33)	16.4 (417)	3 (76)	21.5 (546)
45°	0.0075 (0.19)	0.010 (0.25)	1 to 5 (25 to 127)	1.3 (33)	4.1 (104)	1.5 (38)	2 (51)
	0.015 (0.38)	0.020 (0.51)	1 to 9.5 (25 to 241)	1.3 (33)	7.5 (191)	2 (51)	6 (152)
	0.035 (0.89)	0.050 (1.27)	1 to 23.5 (25 to 597)	1.3 (33)	18.3 (465)	3.8 (97)	19 (483)

Note: Ranges correspond to specific symbol element sizes, and range increases as element size increases.

FIS Options

QX Hawk	
FIS-6800-0110G	QX Hawk, Industrial Imager, CMOS, 15 Degree Optic, Serial
FIS-6800-1110G	QX Hawk, Industrial Imager, CMOS, 15 Degree Optic, Ethernet
FIS-6800-0210G	QX Hawk, Industrial Imager, CMOS, 30 Degree Optic, Serial
FIS-6800-1210G	QX Hawk, Industrial Imager, CMOS, 30 Degree Optic, Ethernet
FIS-6800-0310G	QX Hawk, Industrial Imager, CMOS, 45 Degree Optic, Serial
FIS-6800-1310G	QX Hawk, Industrial Imager, CMOS, 45 Degree Optic, Ethernet

Appendix B — Electrical Specifications

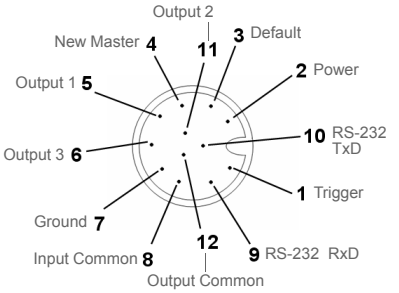
Power Requirement	9 Watts (max.), 10-28VDC, 200 mV p-p max. ripple, 270mA at 24VDC (typ.)

QX Hawk Connectors

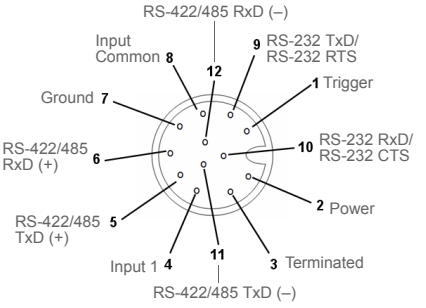
QX Hawk (Back View)

A is a serial M12 12-pin plug.

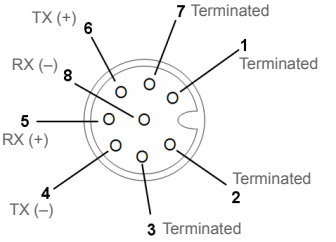
B is a serial M12 12-pin socket **or** an Ethernet M12 8-pin socket.



A (Serial) M12 12-pin Plug



B (Serial) M12 12-pin Socket



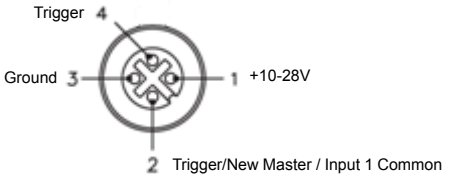
B (Ethernet) M12 8-pin Socket

QX-1 Connectors

Connector T on the QX-1 Interface Device is the Trigger connector.

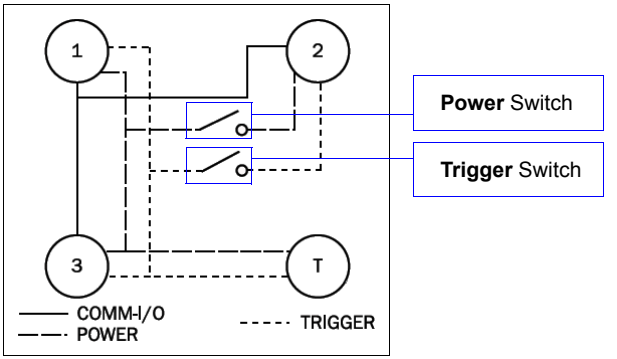
Connectors 1, **2**, and **3** can be used to bus power and data as required by the application.

The connectors on the QX-1 interface device physically mirror those on the QX Hawk imager, but they do not have explicit pin assignments. The QX-1 connectors take on the communications and power roles that are assigned to them.



QX-1 Trigger Connector 4-pin Socket

1	+10-28V
2	Trigger / New Master / Input 1 Common
3	Ground
4	Trigger



QX-1 Wiring Diagram

Connectors 1 and **3** are 12-pin plugs, and **Connector 2** is a 12-pin schprocket. All three connectors can be assigned to bus power and data.

The two switches at the center of the device allow the user to route signals as needed.

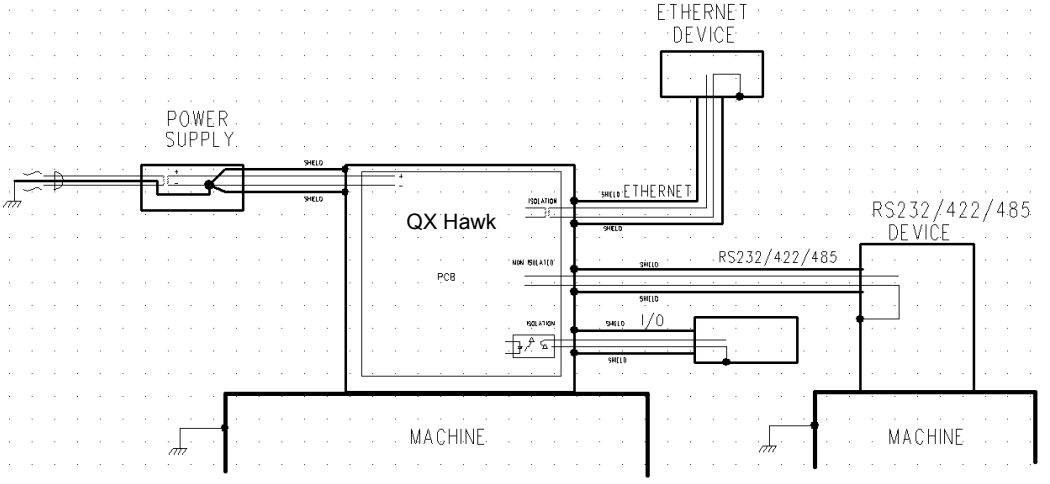
The simple diagram above (also shown on the base of the QX-1) illustrates how power, communications, I/O, and trigger signal can be routed through the QX-1 device.

Power can be bussed between imagers and interface devices. At each location on a network where a new power supply is added, the Power switch on the QX-1 can be used to break power between Connector 2 and Connectors 1, 3, and T.

The **Trigger** signal between Connector 2 and Connectors 1, 3, and T can be broken using the Trigger switch. This isolates trigger signals as required.

Appendix C — Ground and Shield Considerations

Proper grounding is necessary for operator safety, noise reduction, and the protection of equipment from voltage transients. Buildings, including any steelwork, all circuits, and all junction boxes must be grounded directly to an earth ground in compliance with local and national electrical codes.

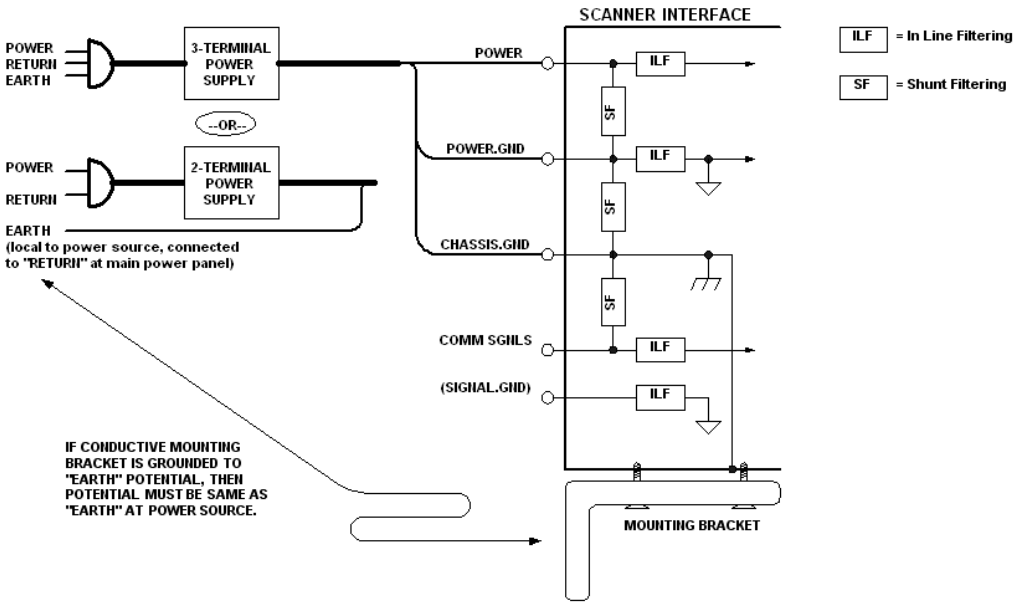


An earth ground is provided through the cable shields and chassis of the imager.

Ground Loops

Ground loops (signal degradation due to different ground potentials in communicating devices) can be eliminated or minimized by ensuring that both the host, imager, and their power supplies are connected to a common earth ground.

Expected Power and Ground Connections for Proper Operation



Notes:

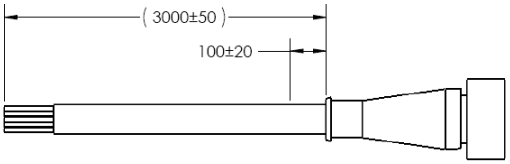
- Ensure that mounting bracket “Earth” is at the same potential as power source “Earth”.
- Supply “Return” and “Earth” ground must be stable, low-impedance reference points.
- “2-Terminal Power Supply” must still provide an “Earth” connection to the imager.
- “Signal Ground” can be used for communications and/or discrete signal ground reference. It must **not** be used as Power Ground or Earth Ground.

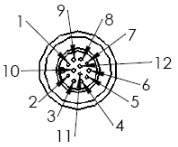
Appendix D — Flying Lead Cordset Pinouts

Microscan offers two flying leads cordsets—61-000166-01 and 61-000167-01—for use in QX hardware configurations. The diagrams below show the correspondence of wire colors to pins.

61-000166-01 — QX Cordset, M12 12-Pin Plug, Flying Leads

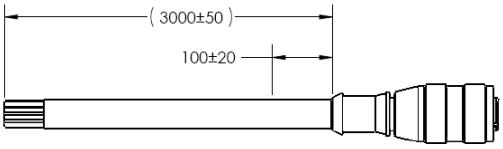
The 61-000166-01 cordset connects to QX Hawk Connector B (serial) and QX-1 Connector 2.

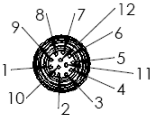




61-000167-01 — QX Cordset, M12 12-Pin Socket, Flying Leads

The 61-000167-01 cordset connects to QX Hawk Connectors A and P/M, and QX-1 Connectors 1 and 3.





Appendix E — Serial Commands

Note: For a list of utility commands such as defaults, read rate requests, device control options, and imager status requests, see **Serial Utility Commands** on page A-64.

Communication	
RS-232 A	<**K100,***baud rate,parity,stop bits,data bits*>
RS-232 B	<**K101,***status,baud rate,parity,stop bits,data bits*>
RS-422	<**K102,***status,baud rate,parity,stop bits,data bits*>
Ethernet	<**K126,***status,IP address,subnet,gateway,IP address mode*>
Ethernet TCP Ports	<**K127,***TCP Port 1,TCP Port 2*>
Search and Configure Mode	<**K128,***ESP Search and Configure Mode*>
RS-232 A Data Type	<**K130,***symbol data output,extra symbol information,diagnostic output,external source processing mode*>
RS-232 B Data Type	<**K131,***symbol data output,extra symbol information,diagnostic output,external source processing mode*>
RS-422 Data Type	<**K132,***symbol data output,extra symbol information,diagnostic output,external source processing mode*>
Ethernet TCP Port 1 Data Type	<**K133,***symbol data output,extra symbol information,diagnostic output,external source processing mode*>
Ethernet TCP Port 2 Data Type	<**K134,***symbol data output,extra symbol information,diagnostic output,external source processing mode*>
Preamble	<**K141,***status,preamble*>
Postamble	<**K142,***status,postamble*>
Response Timeout	<**K143,***response timeout*>
LRC Status	<**K145,***status*>
ACK/NAK Options	<**K147,***RES,REQ,STX,ETX,ACK,NAK*>
Polling Mode Options	<**K148,***RES,REQ,STX,ETX,ACK,NAK*>
Autoconfiguration Daisy Chain	<**K150***DAISY*>
Protocol Selection	<**K160,***protocol,address,protocol port*>
External Data Routing	<**K161,***mode,destination port,ambles to source,echo to source,output at end of read cycle,output at ETX,output at timeout*>
Array Communication Modes	<**K162,***mode,source,daisy chain i.d. status,daisy chain i.d.*>
Read Cycle	
Trigger / Trigger Filter Duration	<**K200,***trigger mode,leading edge trigger filter duration,trailing edge trigger filter duration*>
Serial Trigger Character	<**K201,***serial trigger character*>
External Trigger State	<**K202,***external trigger state*>
End of Read Cycle	<**K220,***mode,read cycle timeout*>
Decodes Before Output	<**K221,***number before output*>
Multisymbol	<**K222,***number of symbols,multisymbol separator*>
Serial Trigger Start Character	<**K229,***start character*>
Serial Trigger Stop Character	<**K230,***stop character*>
Capture Mode	<**K241,***mode,number of captures,rapid capture mode*>

Capture Time	<**K242,***time before first capture,time between 1-2,time between 2-3,time between 3-4,time between 4-5,time between 5-6,time between 6-7,time between 7-8*>
Store No Read Image	<**K244,***image storage type,image storage mode*>
Image Processing Timeout	<**K245,***image processing timeout*>
Number of Symbols in Field of View	<**K518,***number of symbols in field of view*>
Configuration Database	
Number of Active Indexes	<**K252,***number of active indexes,sort database*>
Configuration Database	<**K255,***index,shutter speed,gain,focal distance,sub-sampling,row pointer,column pointer,row depth,column width,threshold mode,fixed threshold value,processing mode,background color,narrow margins,symbol type*>
Load Current Setting from Configuration Database	<**K255–,**index>
Request Database Index Setting	<**K255?,**index>
Request All Database Settings	<**K255?**>
Database Mode	<**K256,***switch mode,frame count/time,image process looping, image dimensions*>
Symbologies	
Composite	<**K453,***symbology status,separator status,separator*>
Micro QR Code	<**K459,***status*>
Code 39	<**K470,***status,check character status,check character output status, large intercharacter gap,fixed symbol length status,fixed symbol length,full ASCII set*>
Codabar	<**K471,***status,start/stop match status,start/stop output status, large intercharacter gap,fixed symbol length status,fixed symbol length,check character type,check character output status*>
Interleaved 2 of 5	<**K472,***status,check character status,check character output status, symbol length 1,symbol length 2,guard bar,range mode status*>
UPC/EAN	<**K473,***UPC status,EAN status,supplementals status,separator status,separator character,supplementals type,UPC-E as UPC-A*>
Code 128 / EAN 128	<**K474,***status,fixed symbol length status,fixed symbol length, EAN status,output format,application record separator status, application record separator character,application record brackets, application record padding*>
Code 93	<**K475,***status,fixed symbol length status,fixed symbol length*>
PDF417	<**K476,***status,unused,fixed symbol length status,fixed symbol length,unused,codeword collection*>
Pharmacode	<**K477,***status,fixed bar count status,fixed bar count,minimum bar count,bar width mode,direction,fixed threshold value,background*>
Data Matrix	<**K479,***ECC 200 status,ECC 000 status,ECC 050 status,ECC 080 status,ECC 100 status,ECC 140 status,ECC 120 status*>
QR Code	<**K480,***status*>
BC412	<**K481,***status,check character output,fixed symbol length status, fixed symbol length*>
DataBar Omnidirectional	<**K482,***status*>
DataBar Limited	<**K483,***status*>
DataBar Expanded	<**K484,***status,fixed symbol length status,fixed symbol length*>

MicroPDF417	<**K485,***status,unused,fixed length status,fixed symbol length*>
Camera Setup	
Camera Settings	<**K541,***shutter speed,gain*>
Sub-Sampling	<**K542,***sub-sampling*>
Focus Distance	<**K525,***focal distance,distance units,lens type*>
Illumination	<**K539,***mode,brightness*>
Window of Interest	<**K516,***row pointer,column pointer,row depth,column width*>
I/O Parameters	
Calibration Options	<**K529,***gain,shutter speed,focus position,symbol type,window of interest framing,window of interest margin*>
Serial Verification	<**K701,***serial command echo status, serial command beep status, control/hex output*>
Beeper	<**K702,***status*>
Quality Output	<**K704,***quality output separator, decodes per trigger status*>
Symbol Data Output	<**K705,***symbol data output status, when to output symbol data*>
Read Duration Output	<**K706,***status,separator*>
Global Symbol Quality Output	<**K708,***quality output separator,output mode*>
ISO/IEC 16022 Parameters	<**K709,***symbol contrast,print growth,axial non-uniformity,unused ECC*>
Data Matrix Grading	<**K710,***percent cell damage,total read time,capture time,locate time,decode time,pixels per element,ECC level,matrix size,quiet zone,symbol angle*>
No Read Message	<**K714,***status,message*>
Input 1	<**K730,***input mode,active state*>
Frame Information	<**K734,***output frame number,output coordinates*>
ISO/IEC 16022 Grade LED Display	<**K737,***unused,LED AIM LED display*>
Green Flash LED	<**K750,***LED status,targeting status,green flash duration*>
Status Indicators	<**K751,***comm,bar graph,I/O 1,I/O 2*>
Database Identifier Output	<**K759,***status,separator character*>
EZ Button	<**K770,***global status,default on power-on,load configuration database, save for power-on*>
EZ Button Modes	<**K771,***single beep,two beeps,three beeps,four beeps*>
Trend Analysis Output 1	<**K780,***trend analysis mode,number of triggers,number to output on,decodes per trigger*>
Trend Analysis Output 2	<**K781,***trend analysis mode,number of triggers,number to output on,decodes per trigger*>
Trend Analysis Output 3	<**K782,***trend analysis mode,number of triggers,number to output on,decodes per trigger*>
Diagnostics Output 1	<**K790,***unused,service unit*>
Diagnostics Output 2	<**K791,***unused,service unit*>
Diagnostics Output 3	<**K792,***unused,service unit*>
Symbol Quality Output 1	<**K800,***Output on Symbol Contrast,Symbol Contrast Threshold, Output on Print Growth,Print Growth Threshold,Output on Axial Non-Uniformity,Axial Non-Uniformity Threshold,Output on Unused ECC,Unused ECC Threshold*>

Symbol Quality Output 2	<**K801,***Output on Symbol Contrast,Symbol Contrast Threshold, Output on Print Growth,Print Growth Threshold,Output on Axial Non-Uniformity,Axial Non-Uniformity Threshold,Output on Unused ECC,Unused ECC Threshold*>
Symbol Quality Output 3	<**K802,***Output on Symbol Contrast,Symbol Contrast Threshold, Output on Print Growth,Print Growth Threshold,Output on Axial Non-Uniformity,Axial Non-Uniformity Threshold,Output on Unused ECC,Unused ECC Threshold*>
Output 1 Parameters	<**K810,***output on,output state,pulse width,output mode*>
Output 2 Parameters	<**K811,***output on,output state,pulse width,output mode*>
Output 3 Parameters	<**K812,***output on,output state,pulse width,output mode*>
Matchcode	
Matchcode	<**K223,***matchcode type,sequential matching,match start position, match length,wild card,sequence on no read,sequence on mismatch*>
Master Symbol Database Size	<**K224,***number of master symbols*>
New Master Pin	<**K225,***status*>
Master Symbol	<**K231,***index,master symbol data*>
Match Replace	<**K735,***status,replacement string*>
Mismatch Replace	<**K736,***status,replacement string*>
Diagnostics	
Hours Since Reset (Read-only)	<**K407**> (returns: *hours,minutes*)
Service Message	<**K409,***status,service message, threshold,resolution*>
User-Defined Name	<**K412,***user-defined name*>
Output Format	
Format Extract	<**K740,***output index,start location,length*>
Format Insert	<**K741,***output index,length,hex string*>
Format Assign	<**K742,***symbol number,status*>
Output Format Status	<**K743,***output format status*>
Output Filter Configuration	<**K744,***filter number,symbology,length,wildcard,placeholder, data,unused,database index*>
Output Filter Enable	<**K745,***number of filters*>

Serial Command Format

Microscan readers are controlled by two types of serial commands: configuration commands and utility commands.

Rules that apply to both configuration and utility commands

- Less than '**<**' and greater than '**>**' angle bracket characters enclose the commands.
- Commands and data are case sensitive. Characters must be entered as upper or lower case, as specified.

Serial Utility Commands

Serial Utility Commands are sent during operations and are not followed by **<A>** or **<Z>**.

Serial Configuration Commands (K Commands)

Microscan's serial configuration commands begin with a single "K" character followed by a 3-digit numeric character, comma-separated command fields, and an initializing command, as follows:

<**K***numeric character,data,data,...etc.*><*initializing command*>

An initializing command **<Z>** or **<A>** may follow the command.

- **<Z>** initializes the imager's memory and saves for power-on.
- **<A>** initializes the imager's memory but does not save for power-on.

For example, to enable **UPC** and save the change for power-on, send **<K473,*1*><Z>**.

To change **Baud Rate** and reset without saving changes for power-on, send **<K100,*3*><A>**.

Serial Configuration Command Conventions

- All command fields (except the last) must be followed by a comma (without a space).
- NULL cannot be used. The characters **<**, **>**, and **,** can be used, but only if entered as hex pairs (see **ASCII Character Entry Modifier**).
- All fields preceding a modified field must be included.
- If there is no change in preceding fields, then commas alone can be entered in these fields. For example, if only the last field in the following command is changing, **<K100,*4,1,0,0*>** can be entered as **<K100,,,,*0*>**.
- All fields *following* a modified field can be omitted. For example, to change Baud Rate only, send **<K100,*3*>**.

Concatenating Configuration Commands

Commands can be concatenated (added together) in a single string. For example, **<K145,*1*><K220,*1*><K450,*1*><A>** enables **LRC**, sets **End of Read Cycle** mode to **New Trigger**, enables **Narrow Quiet Zone**, and resets the data buffers without saving the changes for power-on.

Serial Command Status Request

To ensure that any command was received and accepted, send the **Show Reader Status** command: **<?>**.

The status of a specific serial command can be requested by entering the command followed by a question mark. For example, send **<K142?>** to request the status of **Postamble**.

Entering Control Characters in Serial Commands

To enter control characters within a serial command, hold down the **Ctrl** key while typing the desired character.

Example: To enter a carriage return and line feed (**^M^J**), enter **<K141,1,CNTL-m CNTL-j>**

Serial Configuration Commands

The following serial commands can be entered through ESP's Terminal to control QX Hawk functions. Detailed descriptions of command parameters are available in **Parameters**.

Communication

RS-232 A	<**K100,***baud rate,parity,stop bits,data bits*>
RS-232 B	<**K101,***status,baud rate,parity,stop bits,data bits*>
RS-422	<**K102,***status,baud rate,parity,stop bits,data bits*>
Ethernet	<**K126,***status,IP address,subnet,gateway,IP address mode*>
Ethernet TCP Ports	<**K127,***TCP Port 1,TCP Port 2*>
Search and Configure Mode	<**K128,***ESP Search and Configure Mode*>
RS-232 A Data Type	<**K130,***symbol data output,extra symbol information,diagnostic output,external source processing mode*>
RS-232 B Data Type	<**K131,***symbol data output,extra symbol information,diagnostic output,external source processing mode*>
RS-422 Data Type	<**K132,***symbol data output,extra symbol information,diagnostic output,external source processing mode*>
Ethernet TCP Port 1 Data Type	<**K133,***symbol data output,extra symbol information,diagnostic output,external source processing mode*>
Ethernet TCP Port 2 Data Type	<**K134,***symbol data output,extra symbol information,diagnostic output,external source processing mode*>
Preamble	<**K141,***status,preamble*>
Postamble	<**K142,***status,postamble*>
Response Timeout	<**K143,***response timeout*>
LRC Status	<**K145,***status*>
ACK/NAK Options	<**K147,***RES,REQ,STX,ETX,ACK,NAK*>
Polling Mode Options	<**K148,***RES,REQ,STX,ETX,ACK,NAK*>
Autoconfiguration Daisy Chain	<**K150***DAISY*>
Protocol Selection	<**K160,***protocol,address,protocol port*>
External Data Routing	<**K161,***mode,destination port,ambles to source,echo to source,output at end of read cycle,output at ETX,output at timeout*>
Array Communication Modes	<**K162,***mode,source,daisy chain i.d. status,daisy chain i.d.*>

RS-232 A

Baud Rate, RS-232 A

Serial Cmd: <**K100,*baud rate***,*parity,stop bits,data bits*>

Default: **8 = 115.2K**

Options:

0 = 600	1 = 1200	2 = 2400
3 = 4800	4 = 9600	5 = 19.2K
6 = 38.4K	7 = 57.6K	**8 = 115.2K**
9 = 230K		

Parity, RS-232 A

Serial Cmd: <**K100,***baud rate,***parity***,stop bits,data bits*>
Default: **0 = None**
Options: **0 = None** 1 = Even 2 = Odd

Stop Bits, RS-232 A

Serial Cmd: <**K100,***baud rate,parity,***stop bits***,data bits*>
Default: **0 = One**
Options: **0 = One** 1 = Two

Data Bits, RS-232 A

Serial Cmd: <**K100,***baud rate,parity,stop bits,***data bits***>
Default: **1 = Eight**
Options: 0 = Seven **1 = Eight**

RS-232 B

Status, RS-232 B

Serial Cmd: <**K101,*status***,*baud rate,parity,stop bits,data bits*>
Default: **1 = Enabled**
Options: 0 = Disabled **1 = Enabled**

Baud Rate, RS-232 B

Serial Cmd: <**K101,***status,***baud rate***,parity,stop bits,data bits*>
Default: **8 = 115.2K**
Options: 0 = 600 1 = 1200 2 = 2400
3 = 4800 4 = 9600 5 = 19.2K
6 = 38.4K 7 = 57.6K **8 = 115.2K**
9 = 230K

Parity, RS-232 B

Serial Cmd: <**K101,***status,baud rate,***parity***,stop bits,data bits*>
Default: **0 = None**
Options: **0 = None** 1 = Even 2 = Odd

Stop Bits, RS-232 B

Serial Cmd: <**K101,***status,baud rate,parity,***stop bits***,data bits*>
Default: **0 = One**
Options: **0 = One** 1 = Two

Data Bits, RS-232 B

Serial Cmd: <**K101,***status,baud rate,parity,stop bits,***data bits***>
Default: **1 = Eight**
Options: 0 = Seven **1 = Eight**

RS-422

Status, RS-422

Serial Cmd: <**K102,*status*,***baud rate,parity,stop bits,data bits***>
Default: **0 = Disabled**
Options: **0 = Disabled** 1 = Enabled

Baud Rate, RS-422

Serial Cmd: <**K102,***status,***baud rate***,parity,stop bits,data bits***>*
Default: **8 = 115.2K**
Options: 0 = 600 1 = 1200 2 = 2400
3 = 4800 4 = 9600 5 = 19.2K
6 = 38.4K 7 = 57.6K **8 = 115.2K**
9 = 230K

Parity, RS-422

Serial Cmd: <**K102,***status,baud rate,***parity***,stop bits,data bits***>*
Default: **0 = None**
Options: **0 = None** 1 = Even 2 = Odd

Stop Bits, RS-422

Serial Cmd: <**K102,***status,baud rate,parity,***stop bits***,data bits***>*
Default: **0 = One**
Options: **0 = One** 1 = Two

Data Bits, RS-422

Serial Cmd: <**K102,***status,baud rate,parity,stop bits,***data bits***>*
Default: **1 = Eight**
Options: 0 = Seven **1 = Eight**

Ethernet

Serial Cmd: <**K126,*status*,***IP address,subnet,gateway,IP address mode***>*
Default: **1 = Enabled**
Options: 0 = Disabled **1 = Enabled**

IP Address

Serial Cmd: <**K126,***status,**IP address**,subnet,gateway,IP address mode*>
Default: **192.168.0.100**
Options: 0.0.0.0 – 255.255.255.255

Subnet

Serial Cmd: <**K126,***status,IP address,**subnet**,gateway,IP address mode*>
Default: **255.255.0.0**
Options: 0.0.0.0 – 255.255.255.255

Gateway

Serial Cmd: <**K126,***status,IP address,subnet,**gateway**,IP address mode*>
Default: **0.0.0.0**
Options: 0.0.0.0 – 255.255.255.255

IP Address Mode

Serial Cmd: <**K126,***status,IP address,subnet,gateway,**IP address mode***>
Default: **1 = DHCP**
Options: 0 = Static **1 = DHCP**

Ethernet TCP Ports

TCP Port 1

Serial Cmd: <**K127,*TCP Port 1***,*TCP Port 2*>
Default: **2001**
Options: 1024 – 65535

TCP Port 1

Serial Cmd: <**K127,***TCP Port 1,**TCP Port 2***>
Default: **2003**
Options: 1024 – 65535

RS-232 A Data Type

Symbol Data Output, RS-232 A

Serial Cmd: <**K130,*symbol data output***,*extra symbol information,diagnostic output, external source processing mode*>
Default: **1 = Enabled**
Options: 0 = Disabled **1 = Enabled**

Extra Symbol Information, RS-232 A

Serial Cmd: <**K130,***symbol data output*,***extra symbol information***,*diagnostic output*, *external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Diagnostic Output, RS-232 A

Serial Cmd: <**K130,***symbol data output*,*extra symbol information*,***diagnostic output***, *external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

External Source Processing Mode, RS-232 A

Serial Cmd: <**K130,***symbol data output*,*extra symbol information*,*diagnostic output*, ***external source processing mode***>

Default: **1 = Command**

Options: 0 = Disabled **1 = Command** 2 = Data

RS-232 B Data Type

Symbol Data Output, RS-232 B

Serial Cmd: <**K131,*****symbol data output***,*extra symbol information*,*diagnostic output*, *external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Extra Symbol Information, RS-232 B

Serial Cmd: <**K131,***symbol data output*,***extra symbol information***,*diagnostic output*, *external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Diagnostic Output, RS-232 B

Serial Cmd: <**K131,***symbol data output*,*extra symbol information*,***diagnostic output***, *external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

External Source Processing Mode, RS-232 B

Serial Cmd: <**K131,***symbol data output*,*extra symbol information*,*diagnostic output*, ***external source processing mode***>

Default: **1 = Command**

Options: 0 = Disabled **1 = Command** 2 = Data

RS-422 Data Type

Symbol Data Output, RS-422

Serial Cmd: <**K132,*symbol data output***,*extra symbol information,diagnostic output, external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Extra Symbol Information, RS-422

Serial Cmd: <**K132,***symbol data output*,***extra symbol information***,*diagnostic output, external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Diagnostic Output, RS-422

Serial Cmd: <**K132,***symbol data output,extra symbol information*,***diagnostic output***, *external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

External Source Processing Mode, RS-422

Serial Cmd: <**K132,***symbol data output,extra symbol information,diagnostic output,* ***external source processing mode***>

Default: **1 = Command**

Options: 0 = Disabled **1 = Command** 2 = Data

Ethernet TCP Port 1 Data Type

Symbol Data Output, Ethernet TCP Port 1

Serial Cmd: <**K133,*symbol data output***,*extra symbol information,diagnostic output, external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Extra Symbol Information, Ethernet TCP Port 1

Serial Cmd: <**K133,***symbol data output*,***extra symbol information***,*diagnostic output, external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Diagnostic Output, Ethernet TCP Port 1

Serial Cmd: <**K133,***symbol data output,extra symbol information*,***diagnostic output***,*external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

External Source Processing Mode, Ethernet TCP Port 1

Serial Cmd: <**K133,***symbol data output,extra symbol information,diagnostic output,* ***external source processing mode***>

Default: **1 = Command**

Options: 0 = Disabled **1 = Command** 2 = Data

Ethernet TCP Port 2 Data Type

Symbol Data Output, Ethernet TCP Port 2

Serial Cmd: <**K134,*symbol data output***,*extra symbol information,diagnostic output, external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Extra Symbol Information, Ethernet TCP Port 2

Serial Cmd: <**K134,***symbol data output*,***extra symbol information***,*diagnostic output, external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Diagnostic Output, Ethernet TCP Port 2

Serial Cmd: <**K134,***symbol data output,extra symbol information,***diagnostic output***, external source processing mode*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

External Source Processing Mode, Ethernet TCP Port 2

Serial Cmd: <**K134,***symbol data output,extra symbol information,diagnostic output,* ***external source processing mode***>

Default: **1 = Command**

Options: 0 = Disabled **1 = Command** 2 = Data

Preamble

Preamble Status

Serial Cmd: <**K141,*status*,***preamble character(s)***>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Preamble Characters

Serial Cmd: <**K141,**status**,*preamble character(s)***>

Default: **CR (0x0D)**

Options: 1 – 4 ASCII characters

Postamble

Postamble Status

Serial Cmd: <**K142,status**,*postamble character(s)*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Postamble Characters

Serial Cmd: <**K142,***status,***postamble character(s)***>

Default: **CR LF (0x0D 0x0A)**

Options: 1 – 4 ASCII characters

Response Timeout

Serial Cmd: <**K143,*response timeout***>

Default: **5 (x10 ms = 50)**

Options: 0 to 255 (x10 ms)

LRC Status

Serial Cmd: <**K145,*status***>
Default: **0 = Disabled**
Options: **0 = Disabled** 1 = Enabled

ACK/NAK Options

Serial Cmd: <**K147,***RES,REQ,STX,ETX,ACK,NAK*>

RES-NAK Defaults

RES: (Reset)	00 (disabled)
REQ: (Request)	00 (disabled)
STX: (Start of Text)	00 (disabled)
ETX: (End of Text)	00 (disabled)
ACK: (Acknowledge)	06
NAK: (Negative Acknowledge)	15

Polling Mode Options

Serial Cmd: <**K148,***RES,REQ,STX,ETX,ACK,NAK*>

RES-NAK Defaults

RES: (Reset)	04
REQ: (Request)	05
STX: (Start of Text)	02
ETX: (End of Text)	03
ACK: (Acknowledge)	06
NAK: (Negative Acknowledge)	15

Autoconfiguration Daisy Chain

Serial Cmd: <**K150*DAISY***>

ASCII Character Entry Modifier

Commands that require ASCII text fields, such as **Preamble** and **Postamble** commands, can be sent to the imager as hex pairs (see Appendix G, **ASCII Table**, for conversions).

Serial Cmd Format: **<Knnnh,00-FF>**

To enter ASCII fields as hex values (00 to FF), add a lower-case **h** directly after the command's **K** number, and then enter the hex value that corresponds with the desired ASCII character.

Example:

Serial Cmd: <**K142,***status*,***postamble character(s)***>

The ASCII characters **<**, **>**, and **,** can only be entered as hex pairs. So, to make **>** the postamble in the symbol decode output, enter the **Postamble** command as follows:

<K142h,,3E>

Note that the "status" field contains only a **,** . This is because the only field that is being changed is the "postamble character(s)" field. (See **Serial Configuration Command Conventions** for a more detailed explanation of this command shortcut.)

Protocol Selection

Protocol

Serial Cmd: <**K160,*protocol***,*address,protocol port*>

Options:
0 = Point-to-Point
1 = Point-to-Point with RTS/CTS
2 = Point-to-Point with XON/XOFF
3 = Point-to-Point with RTS/CTS and XON/XOFF
4 = ACK/NAK
5 = Polling Mode

Address

Serial Cmd: <**K160,***protocol,***address***,protocol port*>

Default: **1**

Options: 1 – 50
1 = Poll address 0x1C, select address 0x1D
2 = Poll address 0x1E, select address 0x1F
...
50 = Poll address 0x7E, select address 0x7F

Protocol Port

Serial Cmd: <**K160,***protocol,address,***protocol port***>

Default: **0**

Options: 0 – 1
0 = Main RS-232 on QX Hawk Connector A
1 = RS-422/485 on QX Hawk Connector B

External Data Routing

Mode

Serial Cmd: <**K161,*mode*,***destination port,ambles to source,echo to source,output at end of read cycle,output at ETX,output at timeout***>

Default: **0 = Disabled**

Options: **0 = Disabled**
1 = Transparent
2 = Half Duplex
3 = Full Duplex
4 = Customized

Destination Port

Serial Cmd: <**K161,***mode,***destination port***,ambles to source,echo to source,output at end of read cycle,output at ETX,output at timeout*>

Default: **0 = RS-232 on QX Hawk Connector A**

Options: **0 = RS-232 on QX Hawk Connector A**
1 = RS-232 on QX Hawk Connector B
2 = RS-422 on QX Hawk Connector B
4 = Ethernet TCP Port 1
5 = Ethernet TCP Port 2
6 = EtherNet/IP

Ambles to Source

Serial Cmd: <**K161,***mode,destination port,***ambles to source***,echo to source,output at end of read cycle,output at ETX,output at timeout>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Echo to Source

Serial Cmd: <**K161,***mode,destination port,ambles to source,***echo to source***,output at end of read cycle,output at ETX,output at timeout>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Output at End of Read Cycle

Serial Cmd: <**K161,***mode,destination port,ambles to source,echo to source,***output at end of read cycle***,output at ETX,output at timeout>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Output at ETX

Serial Cmd: <**K161,***mode,destination port,ambles to source,echo to source,output at end of read cycle,***output at ETX***,output at timeout>*

Default: **CR (0x0D)**

Options: Any 7-bit ASCII character

Output at Timeout

Serial Cmd: <**K161,***mode,destination port,ambles to source,echo to source,output at end of read cycle,output at ETX,***output at timeout***>*

Default: **200 (x10 ms = 2 seconds)**

Options: 0 – 65535

Array Communication Modes

Mode

Serial Cmd: <**K162,*mode***,source,daisy chain i.d. status,daisy chain i.d.>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Daisy Chain

Source

Serial Cmd: <**K162,***mode,***source***,daisy chain i.d. status,daisy chain i.d.*>
Default: **1 = RS-232 on QX Hawk Connector B**
Options: 0 = RS-232 on QX Hawk Connector A
1 = RS-232 on QX Hawk Connector B
2 = RS-422 on QX Hawk Connector B
4 = Ethernet TCP Port 1
5 = Ethernet TCP Port 2

Daisy Chain ID Status

Serial Cmd: <**K162,***mode,source,***daisy chain i.d. status***,daisy chain i.d.*>
Default: **0 = Disabled**
Options: **0 = Disabled** 1 = Enabled

Daisy Chain ID

Serial Cmd: <**K162,***mode,source,daisy chain i.d. status,***daisy chain i.d.***>
Default: **1/**
Options: One or two ASCII characters.

Read Cycle

Trigger / Trigger Filter Duration	<**K200,***trigger mode,leading edge trigger filter duration,trailing edge trigger filter duration*>
Serial Trigger Character	<**K201,***serial trigger character*>
External Trigger State	<**K202,***external trigger state*>
End of Read Cycle	<**K220,***mode,read cycle timeout*>
Decodes Before Output	<**K221,***number before output*>
Multisymbol	<**K222,***number of symbols,multisymbol separator*>
Serial Trigger Start Character	<**K229,***start character*>
Serial Trigger Stop Character	<**K230,***stop character*>
Capture Mode	<**K241,***mode,number of captures,rapid capture mode*>
Capture Time	<**K242,***time before first capture,time between 1-2,time between 2-3,time between 3-4,time between 4-5,time between 5-6,time between 6-7,time between 7-8*>
Store No Read Image	<**K244,***image storage type,image storage mode*>
Image Processing Timeout	<**K245,***image processing timeout*>
Number of Symbols in Field of View	<**K518,***number of symbols in field of view*>

Trigger Mode / Filter Duration

Trigger Mode

Serial Cmd: <**K200,*trigger mode***,*leading edge trigger filter,trailing edge trigger filter*>

Default: **0 = Continuous Read**

Options: **0 = Continuous Read**
1 = Continuous Read 1 Output
2 = External Level
3 = External Edge
4 = Serial Data
5 = Serial Data and Edge

Leading Edge Trigger Filter

Serial Cmd: <**K200,***trigger mode,**leading edge trigger filter***,trailing edge trigger filter*>

Default: **313** (~10 ms)

Options: 1 to 65535 (x 32.0 µs)

Trailing Edge Trigger Filter

Serial Cmd: <**K200,***trigger mode,leading edge trigger filter,**trailing edge trigger filter***>

Default: **313** (~10 ms)

Options: 1 to 65535 (x 32.0 µs)

Serial Trigger Character (Delimited)

Serial Cmd: <**K201,*serial trigger character***>

Default: **Space (0x20)**

Options: Any 7-bit ASCII character

External Trigger State

Serial Cmd: <**K202,*active state***>
Default: **1 = Positive**
Options: 0 = Negative **1 = Positive**

End of Read Cycle

End of Read Cycle Mode

Serial Cmd: <**K220,*end of read cycle***,*read cycle timeout*>
Default: **0 = Timeout**
Options: **0 = Timeout**
1 = New Trigger
2 = Timeout or New Trigger
3 = Last Frame
4 = Last Frame or New Trigger

Read Cycle Timeout

Serial Cmd: <**K220,***end of read cycle*,***read cycle timeout***>
Default: **100 (x10 ms = 1 second)**
Options: 1 to 65535

Decodes Before Output

Decodes Before Output

Serial Cmd: <**K221,*decodes before output***,*mode*>
Default: **1**
Options: 1 to 255

Mode

Serial Cmd: <**K221,***decodes before output*,***mode***>
Default: **0 = Non-Consecutive**
Options: **0 = Non-Consecutive** 1 = Consecutive

Multisymbol

Number of Symbols

Serial Cmd: <**K222,*number of symbols***,*multisymbol separator*>
Default: **1**
Options: 1 to 100

Multisymbol Separator

Serial Cmd: <**K222,***number of symbols*,***multisymbol separator***>
Default: **, (comma)**
Options: Any 7-bit ASCII character

Start Trigger Start Character (Non-Delimited)

Serial Cmd: <**K229,*start character***>
Default: **NULL (0x00)**
Options: Two hex digits representing any ASCII character except **<**, **>**, **XON**, and **XOFF**.

Stop Trigger Stop Character (Non-Delimited)

Serial Cmd: <**K230,*stop character***>
Default: **NULL (0x00)**
Options: Two hex digits representing any ASCII character except **<**, **>**, **XON**, and **XOFF**.

Processing Timeout

Serial Cmd: <**K245,*processing timeout***>
Default: **200 (0.2 seconds)**
Options: 1 to 65535

Configuration Database

Number of Active Indexes	<**K252,***number of active indexes,sort database*>
Configuration Database	<**K255,***index,shutter speed,gain,focal distance,sub-sampling,row pointer,column pointer,row depth,column width,threshold mode,fixed threshold value,processing mode,background color,narrow margins, symbol type*>
Load Current Setting	<**K255–,**index>
Request Database Index Setting	<**K255?,**index>
Request All Database Settings	<**K255?**>
Database Mode	<**K256,***switch mode,frame count/time,image process looping, image dimensions*>

Number of Active Indexes

Number of Active Indexes

Serial Cmd: <**K252,*number of active indexes***,*number of database cycles*>
Default: **0 (Disabled)**
Options: 0 to 10

Number of Database Cycles

Serial Cmd: <**K252,***number of active indexes*,***number of database cycles***>
Default: **0 (Disabled)**
Options: 0 to 255

Symbologies

Composite	<**K453,***symbology status,separator status,separator*>
Micro QR Code	<**K459,***status*>
Code 39	<**K470,***status,check character status,check character output status, large intercharacter gap,fixed symbol length status,fixed symbol length,full ASCII set*>
Codabar	<**K471,***status,start/stop match status,start/stop output status, large intercharacter gap,fixed symbol length status,fixed symbol length,check character type,check character output status*>
Interleaved 2 of 5	<**K472,***status,check character status,check character output status, symbol length 1,symbol length 2,guard bar,range mode status*>
UPC/EAN	<**K473,***UPC status,EAN status,supplementals status,separator status,separator character,supplementals type,UPC-E as UPC-A*>
Code 128 / EAN 128	<**K474,***status,fixed symbol length status,fixed symbol length, EAN status,output format,application record separator status, application record separator character,application record brackets, application record padding*>
Code 93	<**K475,***status,fixed symbol length status,fixed symbol length*>
PDF417	<**K476,***status,unused,fixed symbol length status,fixed symbol length,unused,codeword collection*>
Pharmacode	<**K477,***status,fixed bar count status,fixed bar count,minimum bar count,bar width mode,direction,fixed threshold value,background*>
Data Matrix	<**K479,***ECC 200 status,ECC 000 status,ECC 050 status,ECC 080 status,ECC 100 status,ECC 140 status,ECC 120 status*>
QR Code	<**K480,***status*>
BC412	<**K481,***status,check character output,fixed symbol length status, fixed symbol length*>
DataBar Omnidirectional	<**K482,***status*>
DataBar Limited	<**K483,***status*>
DataBar Expanded	<**K484,***status,fixed symbol length status,fixed symbol length*>
MicroPDF417	<**K485,***status,unused,fixed length status,fixed symbol length*>

Composite

Symbology Status (Composite)

Serial Cmd: <**K453,*symbology status***,*separator status,separator*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled 2 = Required

Separator Status (Composite)

Serial Cmd: <**K453,***symbology status,***separator status***,***separator***>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Separator (Composite)

Serial Cmd: <**K453,***symbology status,separator status,***separator***>

Default: **, (comma)**

Options: Any 7-bit ASCII character

Code 39

Serial Cmd: <**K470,*status***,*check character status,check character output status,large intercharacter gap,fixed symbol length status,fixed symbol length,full ASCII set*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Check Character Status (Code 39)

Serial Cmd: <**K470,***status,***check character status***,check character output status,large intercharacter gap,fixed symbol length status,fixed symbol length,full ASCII set*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Check Character Output Status (Code 39)

Serial Cmd: <**K470,***status,check character status,***check character output status***,large intercharacter gap,fixed symbol length status,fixed symbol length,full ASCII set*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Large Intercharacter Gap (Code 39)

Serial Cmd: <**K470,***status,check character status,check character output status,***large intercharacter gap***,fixed symbol length status,fixed symbol length,full ASCII set*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length Status (Code 39)

Serial Cmd: <**K470,***status,check character status,check character output status,large intercharacter gap,***fixed symbol length status***,fixed symbol length,full ASCII set*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length (Code 39)

Serial Cmd: <**K470,***status,check character status,check character output status,large intercharacter gap,fixed symbol length status,***fixed symbol length***,full ASCII set*>

Default: **10**

Options: 1 to 128

Full ASCII Set (Code 39)

Serial Cmd: <**K470,***status,check character status,check character output status,large intercharacter gap,fixed symbol length status,fixed symbol length,***full ASCII set***>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Codabar

Serial Cmd: <**K471,*****status***,*start/stop match,start/stop output,large intercharacter gap,fixed symbol length status,symbol length,check character type,check character output*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Start/Stop Match (Codabar)

Serial Cmd: <**K471,***status,***start/stop match***,start/stop output,large intercharacter gap,fixed symbol length status,symbol length,check character type,check character output*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Start/Stop Output (Codabar)

Serial Cmd: <**K471,***status,start/stop match,***start/stop output***,large intercharacter gap,fixed symbol length status,symbol length,check character type,check character output*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Large Intercharacter Gap (Codabar)

Serial Cmd: <**K471,***status,start/stop match,start/stop output,***large intercharacter gap***,fixed symbol length status,symbol length,check character type,check character output*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length Status (Codabar)

Serial Cmd: <**K471,***status,start/stop match,start/stop output,large intercharacter gap,***fixed symbol length status***,symbol length,check character type,check character output*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Symbol Length (Codabar)

Serial Cmd: <**K471,***status,start/stop match,start/stop output,large intercharacter gap,fixed symbol length status,***symbol length***,check character type,check character output*>

Default: **10**

Options: 1 to 128

Check Character Type (Codabar)

Serial Cmd: <**K471,***status,start/stop match,start/stop output,large intercharacter gap,fixed symbol length status,symbol length,***check character type***,check character output*>

Default: **0 = Disabled**

Options: **0 = Disabled**

1 = Mod 16

2 = NW7 (Mod 11)

3 = Both Mod 16 and NW7 (Mod 11)

Check Character Output (Codabar)

Serial Cmd: <**K471,***status,start/stop match,start/stop output,large intercharacter gap,fixed symbol length status,symbol length,check character type,***check character output***>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Interleaved 2 of 5

Serial Cmd: <**K472,*status***,*check character status,check character output status,symbol length #1,symbol length #2,guard bar status,range mode status*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Check Character Status (Interleaved 2 of 5)

Serial Cmd: <**K472,***status,***check character status***,check character output status,symbol length #1,symbol length #2,guard bar status,range mode status*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Check Character Output Status (Interleaved 2 of 5)

Serial Cmd: <**K472,***status,check character status,***check character output status***,symbol length #1,symbol length #2,guard bar status,range mode status>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Symbol Length #1 (Interleaved 2 of 5)

Serial Cmd: <**K472,***status,check character status,check character output,***symbol length #1***,symbol length #2,guard bar status,range mode status>*

Default: **16**

Options: 0 to 128

Symbol Length #2 (Interleaved 2 of 5)

Serial Cmd: <**K472,***status,check character status,check character output,symbol length #1,***symbol length #2***,guard bar status,range mode status>*

Default: **6**

Options: 0 to 128

Guard Bar Status (Interleaved 2 of 5)

Serial Cmd: <**K472,***status,check character status,check character output,symbol length #1,symbol length #2,***guard bar status***,range mode status>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Range Mode Status (Interleaved 2 of 5)

Serial Cmd: <**K472,***status,check character status,check character output,symbol length #1,symbol length #2,guard bar status,***range mode status***>*

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

UPC/EAN

Serial Cmd: <**K473,*UPC status***,EAN status,supplementals status,separator status, separator character,supplemental type,format UPC-E as UPC-A>*

Default: **3 = Both Standard and Edge-to-Edge**

Options: 0 = Disabled

1 = Standard

2 = Edge-to-Edge

3 = Both Standard and Edge-to-Edge

EAN Status

Serial Cmd: <**K473,***UPC status,**EAN status**,supplementals status,separator status, separator character,supplemental type,format UPC-E as UPC-A>*

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Supplementals Status (UPC/EAN)

Serial Cmd: <**K473,***UPC status,EAN status,**supplementals status**,separator status, separator character,supplemental type,format UPC-E as UPC-A>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled 2 = Required

Separator Status (UPC/EAN)

Serial Cmd: <**K473,***UPC status,EAN status,supplementals status,**separator status**, separator character,supplemental type,format UPC-E as UPC-A>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Separator Character (UPC/EAN)

Serial Cmd: <**K473,***UPC status,EAN status,supplementals status,separator status, **separator character**,supplemental type,format UPC-E as UPC-A>*

Default: **, (comma)**

Options: Any 7-bit ASCII character

Supplemental Type (UPC/EAN)

Serial Cmd: <**K473,***UPC status,EAN status,supplementals status,separator status, separator character,**supplemental type**,format UPC-E as UPC-A>*

Default: **0 = Both**

Options: **0 = Both** 1 = 2 characters only 2 = 5 characters only

Format UPC-E as UPC-A (UPC/EAN)

Serial Cmd: <**K473,***UPC status,EAN status,supplementals status,separator status, separator character,supplemental type,**format UPC-E as UPC-A***>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Code 128/EAN 128

Serial Cmd: <**K474,*status***,*fixed symbol length status,fixed symbol length,EAN 128 status, output format,application record separator status,application record separator character,application record brackets,application record padding,separation factor*>

Default: **3 = Both Standard and Edge-to-Edge**

Options: 0 = Disabled
1 = Standard
2 = Edge-to-Edge
3 = Both Standard and Edge-to-Edge

Fixed Symbol Length Status (Code 128/EAN 128)

Serial Cmd: <**K474,***status*,***fixed symbol length status***,*fixed symbol length,EAN 128 status, output format,application record separator status,application record separator character,application record brackets,application record padding,separation factor*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length (Code 128/EAN 128)

Serial Cmd: <**K474,***status,fixed symbol length status,***fixed symbol length***,EAN 128 status,output format,application record separator status,application record separator character,application record brackets,application record padding, separation factor*>

Default: **10**

Options: 1 to 128

EAN 128 Status (Code 128/EAN 128)

Serial Cmd: <**K474,***status,fixed symbol length status,fixed symbol length,***EAN 128 status***, output format,application record separator status,application record separator character,application record brackets,application record padding,separation factor*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled** 2 = Required

Output Format (Code 128/EAN 128)

Serial Cmd: <**K474,***status,fixed symbol length status,fixed symbol length,EAN 128 status,* ***output format***,*application record separator status,application record separator character,application record brackets,application record padding,separation factor*>

Default: **0 = Standard**

Options: **0 = Standard** 1 = Application

Application Record Separator Status (Code 128/EAN 128)

Serial Cmd: <**K474,***status,fixed symbol length status,fixed symbol length,EAN 128 status, output format,***application record separator status***,application record separator character,application record brackets,application record padding,separation factor>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Application Record Separator Character (Code 128/EAN 128)

Serial Cmd: <**K474,***status,fixed symbol length status,fixed symbol length,EAN 128 status, output format,application record separator status,***application record separator character***,application record brackets,application record padding,separation factor>*

Default: **, (comma)**

Options: Any 7-bit ASCII character

Application Record Brackets (Code 128/EAN 128)

Serial Cmd: <**K474,***status,fixed symbol length status,fixed symbol length,EAN 128 status, output format,application record separator status,application record separator character,***application record brackets***,application record padding,separation factor>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Application Record Padding (Code 128/EAN 128)

Serial Cmd: <**K474,***status,fixed symbol length status,fixed symbol length,EAN 128 status, output format,application record separator status,application record separator character,application record brackets,***application record padding***,separation factor>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Separation Factor

Serial Cmd: <**K474,***status,fixed symbol length status,fixed symbol length,EAN 128 status, output format,application record separator status,application record separator character,application record brackets,application record padding,separation factor>*

Default: **0 = Normal**

Options: **0 = Normal**

1 = High

2 = Highest

Code 93

Serial Cmd: <**K475,*status***,*fixed symbol length status,symbol length*>

Default: **3 = Both Standard and Edge-to-Edge**

Options: 0 = Disabled
1 = Standard
2 = Edge-to-Edge
3 = Both Standard and Edge-to-Edge

Fixed Symbol Length Status (Code 93)

Serial Cmd: <**K475,***status*,***fixed symbol length status***,*symbol length*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Symbol Length (Code 93)

Serial Cmd: <**K475,***status,fixed symbol length status*,***symbol length***>

Default: **10**

Options: 1 to 128

PDF417

Serial Cmd: <**K476,*status***,*unused,fixed symbol length status,fixed symbol length,unused,decode at end of read cycle*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length Status (PDF417)

Serial Cmd: <**K476,***status,unused*,***fixed symbol length status***,*fixed symbol length,unused,decode at end of read cycle*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length (PDF417)

Serial Cmd: <**K476,***status,unused,fixed symbol length status*,***fixed symbol length***,*unused,decode at end of read cycle*>

Default: **10**

Options: 1 to 2710

Decode at End of Read Cycle (PDF417)

Serial Cmd: <**K476,***status,unused,fixed symbol length status,fixed symbol length,unused*,***decode at end of read cycle***>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Pharmacode

Serial Cmd: <**K477,*status***,*fixed symbol length status,fixed symbol length,minimum bars,bar width status,direction,fixed threshold value*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length Status (Pharmacode)

Serial Cmd: <**K477,***status*,***fixed symbol length status***,*fixed symbol length,minimum bars,bar width status,direction,fixed threshold value*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length (Pharmacode)

Serial Cmd: <**K477,***status,fixed symbol length status*,***fixed symbol length***,*minimum bars,bar width status,direction,fixed threshold value*>

Default: **10**

Options: 1 to 16

Minimum Bars (Pharmacode)

Serial Cmd: <**K477,***status,fixed symbol length status,fixed symbol length*,***minimum bars***,*bar width status,direction,fixed threshold value*>

Default: **4**

Options: 1 to 16

Bar Width Status (Pharmacode)

Serial Cmd: <**K477,***status,fixed symbol length status,fixed symbol length,minimum bars*,***bar width status***,*direction,fixed threshold value*>

Default: **0 = Mixed**

Options: **0 = Mixed**
1 = All Narrow
2 = All Wide
3 = Fixed Threshold

Direction (Pharmacode)

Serial Cmd: <**K477,***status,fixed symbol length status,fixed symbol length,minimum bars,bar width status*,***direction***,*fixed threshold value*>

Default: **0 = Forward**

Options: **0 = Forward** 1 = Reverse

Fixed Threshold Value (Pharmacode)

Serial Cmd: <**K477,***status,fixed symbol length status,fixed symbol length,minimum bars,bar width status,direction,****fixed threshold value***>

Default: **400**

Options: 1 to 65535

GS1 DataBar (RSS)

DataBar Omnidirectional (RSS-14)

Serial Cmd: <**K482,*status***>
Default: **0 = Disabled**
Options: **0 = Disabled** 1 = Enabled

DataBar Limited (RSS Limited)

Serial Cmd: <**K483,*status***>
Default: **0 = Disabled**
Options: **0 = Disabled** 1 = Enabled

DataBar Expanded (RSS Expanded)

Serial Cmd: <**K484,*status,***fixed symbol length status,fixed symbol length>
Default: **0 = Disabled**
Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length Status (DataBar Expanded)

Serial Cmd: <**K484,**status,***fixed symbol length status***,fixed symbol length>
Default: **0 = Disabled**
Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length (DataBar Expanded)

Serial Cmd: <**K484,**status,fixed symbol length status,***fixed symbol length***>
Default: **14**
Options: 1 to 74

MicroPDF417

Serial Cmd: <**K485,*status,***unused,fixed symbol length status,fixed symbol length>
Default: **0 = Disabled**
Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length Status (MicroPDF417)

Serial Cmd: <**K485,**status,***fixed symbol length status***,fixed symbol length>
Default: **0 = Disabled**
Options: **0 = Disabled** 1 = Enabled

Fixed Symbol Length (MicroPDF417)

Serial Cmd: <**K485,**status,fixed symbol length status,***fixed symbol length***>
Options: 1 to 366

I/O Parameters

Calibration Options	<**K529,***gain,shutter speed,focus position,symbol type,window of interest framing,window of interest margin*>
Serial Verification	<**K701,***serial command echo status, serial command beep status, control/hex output*>
Beeper	<**K702,***status*>
Quality Output	<**K704,***quality output separator, decodes per trigger status*>
Symbol Data Output	<**K705,***symbol data output status, when to output symbol data*>
Read Duration Output	<**K706,***status,separator*>
Global Symbol Quality Output	<**K708,***quality output separator,output mode*>
ISO/IEC 16022 Parameters	<**K709,***symbol contrast,print growth,axial non-uniformity,unused ECC*>
Data Matrix Grading	<**K710,***percent cell damage,total read time,capture time,locate time,decode time,pixels per element,ECC level,matrix size,quiet zone,symbol angle*>
No Read Message	<**K714,***status,message*>
Input 1	<**K730,***input mode,active state*>
Frame Information	<**K734,***output frame number,output coordinates*>
ISO/IEC 16022 Grade LED Display	<**K737,***unused,LED AIM LED display*>
Green Flash LED	<**K750,***LED status,targeting status,green flash duration*>
Status Indicators	<**K751,***comm,bar graph,I/O 1,I/O 2*>
Database Identifier Output	<**K759,***status,separator character*>
EZ Button	<**K770,***global status,default on power-on,load configuration database, save for power-on*>
EZ Button Modes	<**K771,***single beep,two beeps,three beeps,four beeps*>
Trend Analysis Output 1	<**K780,***trend analysis mode,number of triggers,number to output on,decodes per trigger*>
Trend Analysis Output 2	<**K781,***trend analysis mode,number of triggers,number to output on,decodes per trigger*>
Trend Analysis Output 3	<**K782,***trend analysis mode,number of triggers,number to output on,decodes per trigger*>
Diagnostics Output 1	<**K790,***unused,service unit*>
Diagnostics Output 2	<**K791,***unused,service unit*>
Diagnostics Output 3	<**K792,***unused,service unit*>
Symbol Quality Output 1	<**K800,***Output on Symbol Contrast,Symbol Contrast Threshold, Output on Print Growth,Print Growth Threshold,Output on Axial Non-Uniformity,Axial Non-Uniformity Threshold,Output on Unused ECC,Unused ECC Threshold*>
Symbol Quality Output 2	<**K801,***Output on Symbol Contrast,Symbol Contrast Threshold, Output on Print Growth,Print Growth Threshold,Output on Axial Non-Uniformity,Axial Non-Uniformity Threshold,Output on Unused ECC,Unused ECC Threshold*>
Symbol Quality Output 3	<**K802,***Output on Symbol Contrast,Symbol Contrast Threshold, Output on Print Growth,Print Growth Threshold,Output on Axial Non-Uniformity,Axial Non-Uniformity Threshold,Output on Unused ECC,Unused ECC Threshold*>
Output 1 Parameters	<**K810,***output on,output state,pulse width,output mode*>

Output 2 Parameters	<**K811,***output on,output state,pulse width,output mode*>
Output 3 Parameters	<**K812,***output on,output state,pulse width,output mode*>

Serial Verification

Serial Command Echo Status

Serial Cmd: <**K701,*serial command echo status***,*serial command beep status, control/hex output*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Serial Command Beep Status

Serial Cmd: <**K701,***serial command echo status*,***serial command beep status***, *control/hex output*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Control/Hex Output

Serial Cmd: <**K701,***serial command echo status,serial command beep status,control/hex output*>

Default: **0 = Control**

Options: **0 = Control** 1 = Hex

Beeper

Serial Cmd: <**K702,*beeper status***>

Default: **1 = Good Read**

Options: 0 = Disabled **1 = Good Read** 2 = No Read

Quality Output

Separator

Serial Cmd: <**K704,*separator***,*decodes per trigger status*>

Default: **, (comma)**

Options: Any 7-bit ASCII character

Decodes per Trigger Status

Serial Cmd: <**K704,***separator*,***decodes per trigger status***>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Symbol Data Output

Symbol Data Output Status

Serial Cmd: <**K705,*symbol data output status***,*when to output,symbology i.d. output status*>

Default: **3 = Good Read**

Options: 0 = Disabled 1 = Match 2 = Mismatch **3 = Good Read**

When to Output Symbol Data

Serial Cmd: <**K705,***symbol data output status*,***when to output***,*symbology i.d. output status*>

Default: **0 = As Soon As Possible**

Options: **0 = ASAP** 1 = End of Read Cycle

Symbology ID Output Status

Serial Cmd: <**K705,***symbol data output status,when to output*,***symbology i.d. output status***>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled (AIM-Defined ID) 2 = Readable ID

Read Duration Output

Read Duration Output Mode

Serial Cmd: <**K706,*status***,*separator*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Read Duration Output Separator

Serial Cmd: <**K706,***status*,***separator***>

Default: **Space (0x20)**

Options: Any 7-bit ASCII character

No Read Message

No Read Message Status

Serial Cmd: <**K714,*No Read message status***,*No Read message*>

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

No Read Message

Serial Cmd: <**K714,***no read message status*,***No Read message***>

Default: **NOREAD**

Options: Any valid ASCII string up to 128 characters

Input 1

Serial Cmd: <**K730,*status*,***active state***>*
Default: **0 = Disabled**
Options: **0 = Disabled**
1 = Reset Counts
2 = Unlatch Output

Active State

Serial Cmd: <**K730,***status*,***active state***>*
Default: **0 = Active Open**
Options: **0 = Active Open** 1 = Active Closed

Green Flash LED

Green Flash Mode

Serial Cmd: <**K750,*green flash mode***,*unused,green flash duration*>*
Default: **1 = Good Read**
Options: 0 = Disabled
1 = Good Read
2 = Static Presentation
3 = Match
4 = Mismatch
5 = Strobe

Green Flash Duration

Serial Cmd: <**K750,***green flash mode*,*unused*,***green flash duration***>*
Default: **100 (1 second)**
Options: 0 to 65535 (in 10 ms increments)

Status Indicators

Serial Cmd: <**K751,*status***,*bar graph,I/O 1,I/O 2*>*
Default: **1 = PHY Activity**
Options: 0 = Disabled
1 = PHY Activity
2 = Protocol Activity

Bar Graph

Serial Cmd: <**K751,***status*,***bar graph***,*I/O 1,I/O 2*>*
Default: **1 = Read Rate / Good Read**
Options: 0 = Disabled
1 = Read Rate / Good Read

I/O 1

Serial Cmd: <**K751,***status,bar graph,***I/O 1,***I/O 2*>
Default: **1 = Output Active**
Options: 0 = Disabled
1 = Output Active
2 = Input Active

I/O 2

Serial Cmd: <**K751,***status,bar graph,I/O 1,***I/O 2**>
Default: **2 = Input Active**
Options: 0 = Disabled
1 = Output Active
2 = Input Active

Database Identifier Output

Serial Cmd: <**K759,*status***,*separator*>
Default: **0 = Disabed**
Options: **0 = Disabled** 1 = Enabled

Separator

Serial Cmd: <**K759,***status,****separator***>
Default: **Space (0x20)**
Options: Any 7-bit ASCII character

EZ Button

Global Status

Serial Cmd: <**K770,*global status***,*default on power-on*>
Default: **1 = Enabled**
Options: 0 = Disabled
1 = Enabled
2 = Trigger
3 = Unlatch Outputs
4 = Parameter Switch

Default on Power-On

Serial Cmd: <**K770,***global status,****default on power-on***>
Default: **1 = Enabled**
Options: 0 = Disabled **1 = Enabled**

EZ Button Modes

Serial Cmd: <**K771,***single beep,two beeps,three beeps,four beeps*>

Options: 0 = Disabled 1 = Enabled

Single Beep	Two Beeps	Three Beeps	Four Beeps
0 = Disabled	0 = Disabled	0 = Disabled	0 = Disabled
1 = Read Rate	1 = Read Rate	**1 = Read Rate**	1 = Read Rate
2 = Calibrate	**2 = Calibrate**	2 = Calibrate	2 = Calibrate
3 = Save for Power-On	3 = Save for Power-On	3 = Save for Power-On	**3 = Save for Power-On**
4 = Unused	4 = Unused	4 = Unused	4 = Unused
5 = Load New Master	5 = Load New Master	5 = Load New Master	5 = Load New Master
6 = Unused	6 = Unused	6 = Unused	6 = Unused
7 = Target System	7 = Target System	7 = Target System	7 = Target System
8 = Unused	8 = Unused	8 = Unused	8 = Unused
9 = Bar Code Config.	9 = Bar Code Config.	9 = Bar Code Config.	9 = Bar Code Config.

Trend Analysis Output 1

Trend Analysis Mode

Serial Cmd: <**K780,*trend analysis mode***,*trigger evaluation period,number to output on, decodes per trigger threshold*>

Default: **1 = No Read**

Options: 0 = Mismatch
1 = No Read
2 = Decodes per Trigger

Trigger Evaluation Period

Serial Cmd: <**K780,***trend analysis mode,***trigger evaluation period***,number to output on, decodes per trigger threshold*>

Default: **0**

Options: 0 to 255

Number to Output On

Serial Cmd: <**K780,***trend analysis mode,trigger evaluation period,***number to output on***, decodes per trigger threshold*>

Default: **0**

Options: 0 to 255

Decodes per Trigger Threshold

Serial Cmd: <**K780,***trend analysis mode,trigger evaluation period,number to output on,* ***decodes per trigger threshold***>

Default: **0**

Options: 0 to 65535

Trend Analysis Output 2

Serial Cmd: <**K781,***trend analysis mode,trigger evaluation period,number to output on*>

Trend Analysis Output 3

Serial Cmd: <**K782,***trend analysis mode,trigger evaluation period,number to output on*>

Diagnostics Output 1

Service Unit

Serial Cmd: <**K790,*service unit***>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Diagnostics Output 2

Serial Cmd: <**K791,***service unit*>

Diagnostics Output 3

Serial Cmd: <**K792,***service unit*>

Output 1 Parameters

Output On

Serial Cmd: <**K810,*output on***,*output state,pulse width,output mode*>
Default: **Mismatch or No Read**
Options: **0 = Mismatch or No Read**
1 = Match or Good Read
2 = Mismatch
3 = No Read
4 = Trend Analysis
5 = Validation
6 = Diagnostic Warning
7 = In Read Cycle
8 = Read Cycle Data Valid

Output State

Serial Cmd: <**K810,***output on,***output state***,pulse width,output mode*>
Default: **0 = Normally Open**
Options: **0 = Normally Open** 1 = Normally Closed

Pulse Width

Serial Cmd: <**K810,***output on,output state,***pulse width***,output mode*>
Default: **500**
Options: 1 to 65535 (in 1 ms increments)

Output Mode

Serial Cmd: <**K810,***output on,output state,pulse width,***output mode***>
Default: **0 = Pulse**
Options: **0 = Pulse**
1 = Latch Mode 1 (Unlatch Input 1 Pin)
2 = Latch Mode 2 (Unlatch Opposite Condition)
3 = Latch Mode 3 (Unlatch Re-Enter Read Cycle)

Output 2 Parameters

Serial Cmd: <**K811,***output on,output state,pulse width,output mode*>

Output 3 Parameters

Serial Cmd: <**K812,***output on,output state,pulse width,output mode*>

Matchcode

Matchcode	<**K223,***matchcode type,sequential matching,match start position, match length,wild card,sequence on no read,sequence on mismatch*>
Master Symbol Database Size	<**K224,***number of master symbols*>
New Master Pin	<**K225,***status*>
Master Symbol	<**K231,***index,master symbol data*>
Match Replace	<**K735,***status,replacement string*>
Mismatch Replace	<**K736,***status,replacement string*>

Matchcode Type

Serial Cmd: <**K223,*matchcode type***,*sequential matching,match start position, match length,wild card character,sequence on No Read,sequence on mismatch*>

Default: **0 = Disabled**

Options: **0 = Disabled**
1 = Enabled
2 = Wild Card
3 = Sequential

Sequential Matching

Serial Cmd: <**K223,***matchcode type,**sequential matching**,match start position,match length,wild card character,sequence on No Read,sequence on mismatch*>

Default: **0 = Increment**

Options: **0 = Increment** 1 = Decrement

Match Start Position

Serial Cmd: <**K223,***matchcode type,sequential matching,**match start position**, match length,wild card character,sequence on No Read,sequence on mismatch*>

Default: **0**

Options: 0 to 3000

Match Length

Serial Cmd: <**K223,***matchcode type,sequential matching,match start position,**match length**,wild card character,sequence on No Read,sequence on mismatch*>

Default: **1**

Options: 1 to 3000

Wild Card Character

Serial Cmd: <**K223,***matchcode type,sequential matching,match start position,match length,***wild card character,***sequence on No Read,sequence on mismatch>*

Default: *** (asterisk)**

Options: Any 7-bit ASCII character

Sequence on No Read

Serial Cmd: <**K223,***matchcode type,sequential matching,match start position,match length,wild card character,***sequence on No Read,***sequence on mismatch>*

Default: **1 = Enabled**

Options: 0 = Disabled **1 = Enabled**

Sequence on Mismatch

Serial Cmd: <**K223,***matchcode type,sequential matching,match start position,match length,wild card character,sequence on No Read,***sequence on mismatch***>*

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Master Symbol Database Size

Serial Cmd: <**K224,*number of master symbols***>

Default: **1**

Options: 1 to 10

New Master Pin

Serial Cmd: <**K225,*status***>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Master Symbol

Index

Serial Cmd: <**K231,*index***,*master symbol data*>

Options: 1 to 32768

Master Symbol Data

Serial Cmd: <**K231,***index,****master symbol data***>*

Options: Any valid ASCII string

Match Replace

Serial Cmd: <**K735,*status***,*replacement string*>

Default: **0 = Disabled**

Options: **0 = Disabled** 1 = Enabled

Replacement String

Serial Cmd: <**K735,***status*,***replacement string***>
Default: **MATCH**
Options: Any valid ASCII string up to 128 characters

Mismatch Replace

Serial Cmd: <**K736,*status***,*replacement string*>
Default: **0 = Disabled**
Options: **0 = Disabled** 1 = Enabled

Replacement String

Serial Cmd: <**K736,***status*,***replacement string***>
Default: **MISMATCH**
Options: Any valid ASCII string up to 128 characters

Diagnostics

Hours Since Reset (Read-only)	<**K407**> (returns: *hours,minutes*)
Service Message	<**K409,***status,service message, threshold,resolution*>
User-Defined Name	<**K412,***user-defined name*>

Hours Since Reset (Read-only)

Hours

Serial Cmd: <**K407,*hours***,*minutes*>
16-bit counter (0 to 65535)

Minutes

Serial Cmd: <**K407,***hours*,***minutes***>
16-bit counter (0 to 60)

Service Message

Serial Cmd: <**K409,*status,***service message,threshold,resolution>
Default: **0 = Disabled**
Options: **0 = Disabled** 1 = Enabled

Service Message

Serial Cmd: <**K409,***status*,***service message***,threshold,resolution>
Default: **SERVICE**
Options: Any valid ASCII string up to 128 characters

Threshold

Serial Cmd: <**K409,***status,service message*,***threshold***,resolution>
Default: **300 (5 minutes)**
Options: 1 to 65535

Resolution

Serial Cmd: <**K409,***status,service message,threshold*,***resolution***>
Default: **0 = Seconds**
Options: **0 = Seconds** 1 = Minutes

User-Defined Name

Serial Cmd: <**K412,*user-defined name***>
Default: **QX Hawk**
Options: Any valid ASCII string up to 50 characters

Output Format

Format Extract	<**K740,***output index,start location,length*>
Format Insert	<**K741,***output index,length,hex string*>
Format Assign	<**K742,***symbol number,status*>
Output Format Status	<**K743,***output format status*>
Output Filter Configuration	<**K744,***filter number,symbology,length,wildcard,placeholder, data,unused,database index*>
Output Filter Enable	<**K745,***number of filters*>

Format Extract

Output Index

Serial Cmd: <**K740,*output index***,*start location,length*>

Options: 1 to 100

Start Location

Serial Cmd: <**K740,***output index,**start location**,length*>

Default: **0**

Options: 1 to *n* (maximum number of characters in the symbol data).

Length

Serial Cmd: <**K740,***output index,start location,**length***>

Default: **0 (Disabled; end of format cell array)**

Options: 1 to *n* (maximum number of characters in the symbol data).

Format Insert

Output Index

Output Index refers to the database entry to be modified with this command. A formatted output is built by extracting data from a symbol's original data output and/or inserting user-defined characters.

It may be helpful to think of individual indexes as positions in the final formatted output. Starting with index # 1, enter either an extract or insert command to begin building the required output string. Then, with the next index number, enter either an extract or insert command to continue building the output string. Continue this process until the string is complete.

Serial Cmd: <**K741,*output index***,*length,hex string*>

Options: 1 to 100

Length

Specifies the length of the user-defined character string that will be inserted. This function is limited to 4 characters per output index, so multiple indexes must be entered in order to insert longer character sequences.

For example, to insert a 10-character sequence in user-defined output, three commands with consecutive index numbers would be required, where the first two character sequence lengths were 4 and the third was 2.

Serial Cmd: <**K741,***output index,***length**,*hex string*>

Default: **0 (Disabled; end of format cell array)**

Options: 1 to 4

Hex String

Specifies a character string that represents ASCII characters to be inserted in the database entry. Two hex characters are required for every ASCII character to be inserted in the user-defined output string. These two characters comprise the hex (base 16) value of the ASCII character.

For example, to enter the three-character sequence “Hi!”, **3** would indicate the length of the string, and a hex sequence of **486921** would be the ASCII sequence to be inserted. (48 = H; 69 = i; 21 = !)

Important: Each pair of hex characters represents one ASCII character. Hex character pairs range from 00 to FF. Since there is a limit of 4 ASCII characters per insertion per database entry, there is a limit of 8 hex characters per insertion per database entry.

Serial Cmd: <**K741,***output index,length,***hex string**>

Default: **NULL (0x00)**

Options: 00 to FF (As many as 4 bytes, or hex pairs.)

Format Assign

Symbol Number

Serial Cmd: <**K742**,***symbol number***,*status*>

Options: 1 to 10
1 = Formatted output status for symbol # 1.
2 = Formatted output status for symbol # 2.
...
...
10 = Formatted output status for symbol # 10.

Status

Serial Cmd: <**K742**,*symbol number*,***status***>

Default: **0 = Disabled**

Options: **0 = Disabled**
1 = Enabled (Assign parameters to specified symbol.)

Output Format Status

Serial Cmd: <**K743**,***output format status***>

Default: **0 = Disabled**

Options: **0 = Disabled**
1 = Enabled

Output Filter Configuration

Filter Number

Serial Cmd: <**K744**,***filter number***,*symbology type,length,wildcard,placeholder,data, decode direction,database index*>

Options: 1 to 10

Symbology Type

Serial Cmd: <**K744,***filter number,***symbology type***,length,wildcard,placeholder,data, decode direction,database index>*

Default: **0**

Options:
0 = Any type
1 = Interleaved 2 of 5
2 = Code 39
3 = Code 128
4 = Codabar
5 = UPC
6 = PDF417
7 = EAN 128
8 = Code 93
9 = Pharmacode
10 = GS1 DataBar (RSS)
12 = Composite

Length

Serial Cmd: <**K744,***filter number,symbology type,***length***,wildcard,placeholder,data, decode direction,database index>*

Default: **0**

Options: 0 to 128

Wildcard

Serial Cmd: <**K744,***filter number,symbology type,length,***wildcard***,placeholder,data, decode direction,database index>*

Default: *** = (0x2A)**

Options: Any ASCII input in the form of a pair of hex characters

Placeholder

Serial Cmd: <**K744,***filter number,symbology type,length,wildcard,***placeholder***,data, decode direction,database index>*

Default: **? = (0x3F)**

Options: Any ASCII input in the form of a pair of hex characters

Data

Serial Cmd: <**K744,***filter number,symbology type,length,wildcard,placeholder,***data***, decode direction,database index>*

Default: **NULL (0x00)**

Options: Any ASCII input in the form of a pair of hex characters

Decode Direction

Serial Cmd: <**K744,***filter number,symbology type,length,wildcard,placeholder,data,* ***decode direction****,database index*>

Default: **0 = Any Direction**

Options: **0 = Any Direction**

1 = Forward

2 = Reverse

Database Index

Serial Cmd: <**K744,***filter number,symbology type,length,wildcard,placeholder,data, decode direction,* ***database index***>

Default: **0** (any index)

Options: 0 to 10

Output Filter Enable

Serial Cmd: <**K745,*number of filters***>

Default: **0**

Options: 0 to 10

Serial Utility Commands

Type	Command	Name
Bar Code Configuration	<**BCCFG**>	Enter Bar Code Configuration
Calibration	<**@CAL**>	Calibrate
	<**@OPTIC**>	Initiate Lens Calibration
Counters	<**N**>	No Read Counter
	<**O**>	No Read Counter Reset
	<**T**>	Trigger Counter
	<**U**>	Trigger Counter Reset
	<**V**>	Good Read/Match Counter
	<**W**>	Good Read/Match Counter Reset
	<**X**>	Mismatch Counter
	<**Y**>	Mismatch Counter Reset
Default/Reset/Save	<**A**>	Software Reset – Retain Current Parameters
	<**Ard**>	Software Reset – Recall Factory Defaults
	<**Arp**>	Software Reset – Recall Power-On Defaults
	<**Arc**>	Software Reset – Recall Customer Defaults
	<**Z**>	Software Reset – Save Current Settings for Power-On
	<**Zc**>	Software Reset – Save Current Settings as Customer Defaults
	<**Zrd**>	Software Reset – Recall Factory Defaults and Save for Power-On
	<**Zrc**>	Software Reset – Recall Customer Defaults and Save for Power-On
Device Control	<**L1**>	Programmable Output 1
	<**L2**>	Programmable Output 2
	<**L3**>	Programmable Output 3
	<**I**>	Disable Imager
	<**H**>	Enable Imager
Firmware/Checksum	<**#**>	Display All Part Numbers
	<**#a**>	Display Application Code Part Number
	<**#b**>	Display Boot Code Part Number
	<**#d**>	Display DSP Code Part Number
	<**#k**>	Display Kernel Code Part Number
	<**#s**>	Display SafeMode Part Number
	<**#.**>	Display All Firmware Build Numbers
	<**#a.**>	Display Application Code Build Number
	<**#b.**>	Display Boot Code Build Number
	<**#d.**>	Display DSP Code Build Number
	<**#k.**>	Display Kernel Code Build Number
	<**!**>	Display All Available Firmware Checksums

Firmware/Checksum	<**!a**>	Display Application Code Code Checksum
	<**!d**>	Display DSP Code Checksum
	<**rb,***key*>	Roll Back Application Code
Imager Status	<**?**>	Imager Status Request
	<**K?**>	All Status Request
	<**K??**>	All Descriptor Request
	<**K?#**>	All Range Request
	<**Knnn?**>	Single Status Request
	<**Knnn??**>	Single Descriptor Request
	<**Knnn?#**>	Single Range Request
	<**Knnnd**>	Single Command Default
Learn	<**LEARN**>	Initiate Learn Operation
	<**UNLEARN**>	Initiate Unlearn Operation
	<**LEARN?**>	Display Learn Status
Master Database	<**G**>	Store Next Decoded Symbol to Database Index 1
	<**G***n*>	Store Next Decoded Symbol to Database Index *n*
	<**NEWM**>	New Master Load Status
Read Rate	<**C**>	Enter Decodes/Second Test
	<**Cp**>	Enter Decode Percent Test
	<**J**>	Exit Decodes/Second and Decode Percent Tests
Reboot System	<**reboot**>	Cold Boot System from Boot Code
Static Validation	<**VAL**>	Perform Static Validation of Data Matrix Symbol
Targeting	<**l1**>	Activate Targeting System
	<**l0**>	De-activate Targeting System
Temperature	<**@TEMP**>	Display Image Sensor Temperature
Y-Modem Transfer Options	<**uy,***path and image file name*>	Y-Modem Upload
	<**dy,***key*>	Y-Modem Download (Code)

Appendix F — Protocol Commands

Communication Protocol Command Table

Protocol Command (Mnemonic displayed on menu)	Control Characters (Entered in menu or serial command)	Hex Value	Effect of Command
RES	^D	04	Reset
REQ	^E	05	Request
EOT	^D	04	Reset
STX	^B	02	Start of Text
ETX	^C	03	End of Text
ACK	^F	06	Acknowledge
NAK	^U	15	Negative Acknowledge
XON	^Q	11	Begin Transmission
XOFF	^S	13	Stop Transmission

ACK/NAK Data Flow Examples

Setup 1

RES	0x00 (disabled)
REQ	0x00 (disabled)
STX	0x00 (disabled)
ETX	0x00 (disabled)
ACK	0x06
NAK	0x15
LRC	disabled

Transfer 1

HOST_TX	<K141,0>
imager_TX	‘ACK’

Transfer 2

HOST_TX	<K141?>
imager_TX	‘ACK’
imager_TX	<K141,0>
HOST_TX	‘ACK’

Error Condition

Transfer 1

imager_TX	symbol data
HOST_TX	‘NAK’ (host rejects)
imager_TX	symbol data (resend data)
HOST_TX	‘ACK’ (transaction complete)

Transfer 2

HOST_TX	<K141?>
imager_TX	‘ACK’
imager_TX	<K141,0>
	timeout reached...
	timeout reached...
	timeout reached...
Timeout Reached	transaction aborted, data is flushed

Setup 2

RES	0x00 (disabled)
REQ	0x00 (disabled)
STX	0x00 (disabled)
ETX	0x00 (disabled)
ACK	0x06
NAK	0x15
LRC	enabled

Transfer 1

HOST_TX	<K141,0>a
imager_TX	‘ACK’

Transfer 2

HOST_TX	<K141?>B
imager_TX	‘ACK’
imager_TX	<K141,0>a
HOST_TX	‘ACK’

Error Condition

Transfer 1

HOST_TX	<k141,0>x (BAD LRC)
imager_TX	‘NAK’
HOST_TX	<K141,0>a (GOOD LRC)
imager_TX	‘ACK’

Setup 3

RES	0x00 (disabled)
REQ	0x00 (disabled)
STX	0x28 ‘(‘
ETX	0x29 ‘)’
ACK	0x06
NAK	0x15
LRC	enabled

Transfer 1

HOST_TX	(<K141,0>)H
imager_TX	‘ACK’

Transfer 2

HOST_TX	(<K141?>)k
imager_TX	‘ACK’
imager_TX	(<K141,^M>)w
HOST_TX	‘ACK’

Setup 4

RES 0x21 '!'
REQ 0x3D '='
STX 0x28 '('
ETX 0x29 ')'
ACK 0x06
NAK 0x15
LRC enabled

Transfer 1

HOST_TX (<K141,0>)H
imager_TX 'ACK'

Transfer 2

HOST_TX (<K100?>)n
imager_TX 'ACK'
HOST_TX '!'
imager_TX (<K100,8,0,0,1>)X
HOST_TX 'ACK'
imager_TX '!'

Error Condition

Transfer 1

HOST_TX (<K141,0>)H
imager_TX 'ACK'
HOST_TX (<K100?>)n
imager_TX 'ACK'
HOST_TX '!'
imager_TX (<K100,8,0,0,1>)X
timeout reached...
imager_TX '='
timeout reached...
imager_TX '='
timeout reached...
imager_TX '='
timeout reached...
imager_TX '!'

Polling Mode Data Flow Examples

Setup 1

Address	0x01 (translates to) Poll Req @ ‘0x1C’, Unit Select @ ‘0x1D’
RES	0x04
REQ	0x05
STX	0x02
ETX	0x03
ACK	0x06
NAK	0x15
LRC	disabled

Transfer 1

HOST_TX	‘RES’ ‘0x1D’ ‘REQ’ (Select Unit 1 to receive data)
imager_TX	‘0x1D’ ‘ACK’ (Unit responds with its address)
HOST_TX	‘STX’ <T> ‘ETX’
imager_TX	‘0x1D’ ‘ACK’ (Unit responds with its address)
HOST_TX	‘RES’ (Terminate Transfer 2)

Transfer 2

HOST_TX	‘RES’ ‘0x1C’ ‘REQ’ (Poll Unit 1 for data)
imager_TX	‘0x1C’ ‘STX’ <T/00000> ‘ETX’
HOST_TX	‘ACK’
imager_TX	‘RES’ (Terminate Transfer 1)

Starting with a ‘RES’ ensures a clean transaction, without “leftovers” from the previous transaction.

Error Condition 1

HOST_TX	‘RES’ ‘0x1C’ ‘REQ’ (Poll Unit 1 for data)
imager_TX	‘0x1C’ ‘STX’ <T/00000> ‘ETX’
HOST_TX	‘*Nothing*’ (Host should ‘ACK’ here)
	timeout reached...
imager_TX	‘REQ’ (Unit requests an ‘ACK’ again)
	timeout reached...
imager_TX	‘REQ’ (Unit requests an ‘ACK’ again)
	timeout reached...
imager_TX	‘REQ’ (Unit requests an ‘ACK’ again)
	timeout reached...
imager_TX	‘RES’ (Terminate Transfer 1, data is flushed)

Error Condition 2

HOST_TX	‘RES’ ‘0x1C’ ‘REQ’ (Poll Unit 1 for data)
imager_TX	‘0x1C’ ‘STX’ <T/00000> ‘ETX’
HOST_TX	‘*Nothing*’ (Host should ‘ACK’ here)
	timeout reached...
imager_TX	‘REQ’ (Unit requests an ‘ACK’ again)
HOST_TX	‘*NAK*’ (Host rejects data frame)
	(Retry Event)
imager_TX	‘0x1C’ ‘STX’ <T/00000> ‘ETX’ (Unit sends again)
HOST_TX	‘ACK’ (Host receives data)
imager_TX	‘RES’ (Terminate Transfer 1)

The protocol makes 3 retry attempts before data is flushed and transfer is aborted.

Setup 2

Address	0x01 (translates to) Poll Req @ '0x1C', Unit Select @ '0x1D'
RES	0x04
REQ	0x05
STX	0x02
ETX	0x03
ACK	0x06
NAK	0x15
LRC	enabled

Transfer 1

HOST_TX	'RES' '0x1D' 'REQ' (Select Unit 1 to receive data)
imager_TX	'0x1D' 'ACK' (Unit responds with its address)
HOST_TX	'STX' <T> 'ETX' 'LRC'
imager_TX	'0x1D' 'ACK' (Unit responds with its address)
HOST_TX	'RES' (Terminate Transfer 2)

Transfer 2

HOST_TX	'RES' '0x1C' 'REQ' (Poll Unit 1 for data)
imager_TX	'0x1C' 'STX' <T/00000> 'ETX' 'LRC'
imager_TX	'ACK'
HOST_TX	'RES' (Terminate Transfer 1)

Starting with a 'RES' ensures a clean transaction, without "leftovers" from the previous transaction.

Error Condition 1

HOST_TX	'RES' '0x1C' 'REQ' (Poll Unit 1 for data)
imager_TX	'0x1C' 'STX' <T/00000> 'ETX' 'LRC'
HOST_TX	'*Nothing*' (Host should 'ACK' here)
	timeout reached...
imager_TX	'REQ' (Unit requests an 'ACK' again)
	timeout reached...
imager_TX	'REQ' (Unit requests an 'ACK' again)
	timeout reached...
imager_TX	'REQ' (Unit requests an 'ACK' again)
	timeout reached...
imager_TX	'RES' (Terminate Transfer 1, data is flushed)

Error Condition 2

HOST_TX	'RES' '0x1C' 'REQ' (Poll Unit 1 for data)
imager_TX	'0x1C' 'STX' <T/00000> 'ETX' 'LRC'
HOST_TX	'*Nothing*' (Host should 'ACK' here)
	timeout reached...
imager_TX	'REQ' (Unit requests an 'ACK' again)
HOST_TX	'*NAK*' (Host rejects data frame)
	(Retry Event)
imager_TX	'0x1C' 'STX' <T/00000> 'ETX' 'LRC' (Unit sends again)
HOST_TX	'ACK' (Host receives data)
imager_TX	'RES' (Terminate Transfer 1)

Error Condition 3

HOST_TX	'RES' '0x1C' 'REQ' (Poll Unit 1 for data)
imager_TX	'0x1C' 'STX' <T/00000> 'ETX' 'BAD LRC'
HOST_TX	'NAK' (Host rejects bad LRC data)
(Retry Event)	
imager_TX	'0x1C' 'STX' <T/00000> 'ETX' 'GOOD LRC' (Unit sends again)
HOST_TX	'ACK' (Host receives data)
imager_TX	'RES' Terminate Transfer 1)

The protocol makes 3 retry attempts before data is flushed and transfer is aborted.

Appendix G — ASCII Table

Dec	Hex	Mne	Ctrl
00	00	NUL	^@
01	01	SOH	^A
02	02	STX	^B
03	03	ETX	^C
04	04	EOT	^D
05	05	ENQ	^E
06	06	ACK	^F
07	07	BEL	^G
08	08	BS	^H
09	09	HT	^I
10	0A	LF	^J
11	0B	VT	^K
12	0C	FF	^L
13	0D	CR	^M
14	0E	SO	^N
15	0F	SI	^O
16	10	DLE	^P
17	11	DC1	^Q
18	12	DC2	^R
19	13	DC3	^S
20	14	DC4	^T
21	15	NAK	^U
22	16	SYN	^V
23	17	ETB	^W
24	18	CAN	^X
25	19	EM	^Y
26	1A	SUB	^Z
27	1B	ESC	^[
28	1C	FS	^\
29	1D	GS	^]
30	1E	RS	^^
31	1F	US	^_

Dec	Hex	Ch
32	20	SP
33	21	!
34	22	“
35	23	#
36	24	$
37	25	%
38	26	&
39	27	'
40	28	(
41	29	)
42	2A	*
43	2B	+
44	2C	,
45	2D	-
46	2E	.
47	2F	/
48	30	0
49	31	1
50	32	2
51	33	3
52	34	4
53	35	5
54	36	6
55	37	7
56	38	8
57	39	9
58	3A	:
59	3B	;
60	3C	<
61	3D	=
62	3E	>
63	3F	?

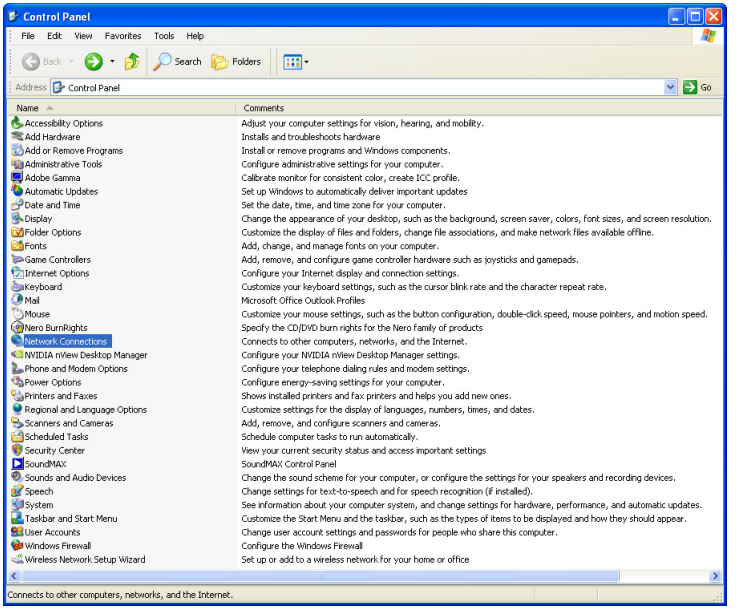
Dec	Hex	Ch
64	40	@
65	41	A
66	42	B
67	43	C
68	44	D
69	45	E
70	46	F
71	47	G
72	48	H
73	49	I
74	4A	J
75	4B	K
76	4C	L
77	4D	M
78	4E	N
79	4F	O
80	50	P
81	51	Q
82	52	R
83	53	S
84	54	T
85	55	U
86	56	V
87	57	W
88	58	X
89	59	Y
90	5A	Z
91	5B	[
92	5C	\
93	5D	]
94	5E	^
95	5F	_

Dec	Hex	Ch
96	60	`
97	61	a
98	62	b
99	63	c
100	64	d
101	65	e
102	66	f
103	67	g
104	68	h
105	69	i
106	6A	j
107	6B	k
108	6C	l
109	6D	m
110	6E	n
111	6F	o
112	70	p
113	71	q
114	72	r
115	73	s
116	74	t
117	75	u
118	76	v
119	77	w
120	78	x
121	79	y
122	7A	z
123	7B	{
124	7C	|
125	7D	}
126	7E	~
127	7F	D

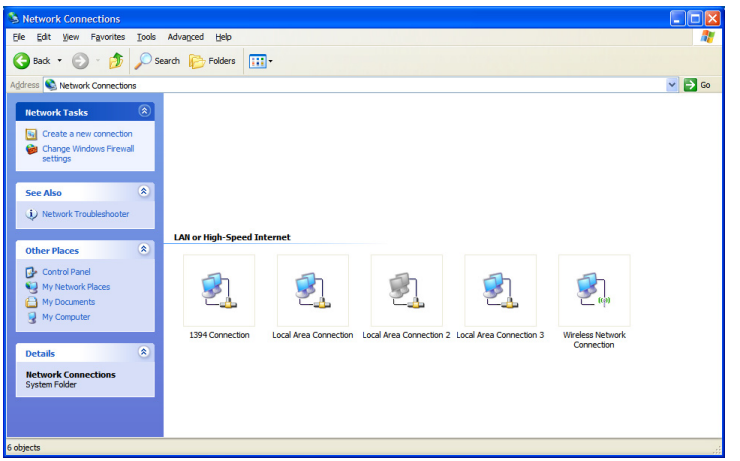
Appendix H — Configuring Ethernet TCP/IP

When using Ethernet to deploy QX Hawks in an application, the host computer must be in the same IP range as the devices. Network settings are accessible in Windows from the Control Panel. The steps below show how TCP/IP settings can be configured.

1. From the **Windows Start Menu**, open **Control Panel** and double-click **Network Connections**.



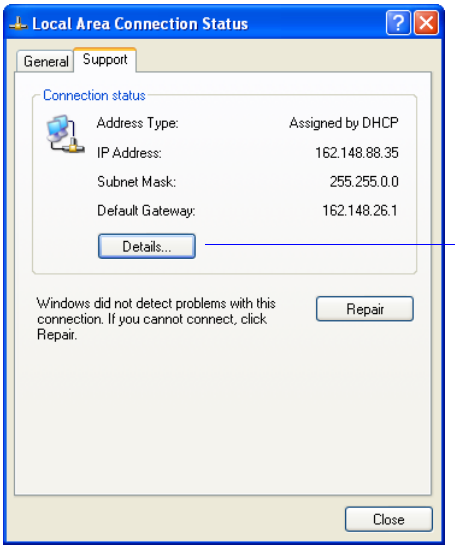
2. The **Network Connections** dialog will appear. Double-click the icon for the Local Area Connection being used in the application.



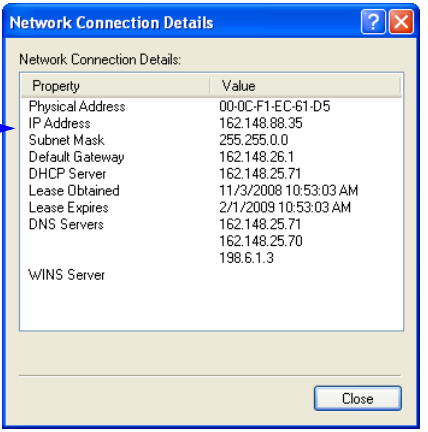
Configuring Ethernet TCP/IP (cont.)

3. The **Local Area Connection Status** dialog will appear. To check the host computer's connection settings, click **Details** on the **Support** tab.

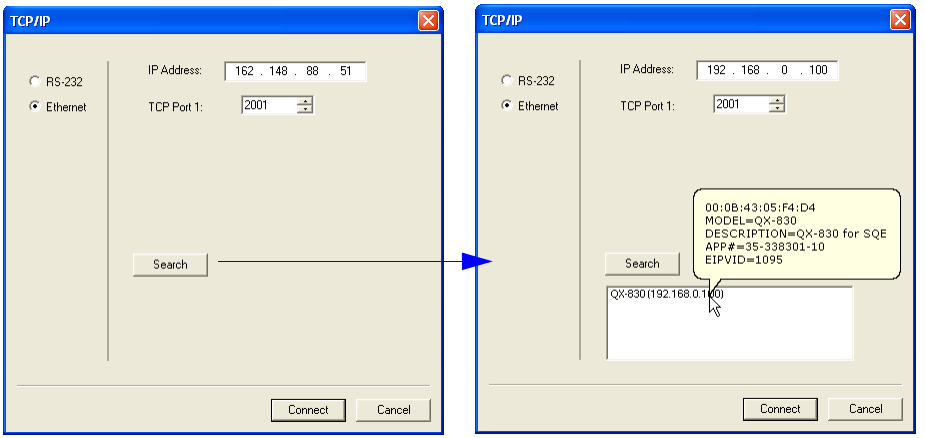
   To verify connection status:



On the **Support** tab, click the **Details** button to bring up a list of **Network Connection Details**.



4. A connected QX Hawk's default address information can be verified in ESP by clicking the **Search** button in the **Connection Wizard**. Compare the imager's IP address to the host's IP address to determine whether or not they are in the same subnet range (this can be determined by your I.T. department if you are unsure).

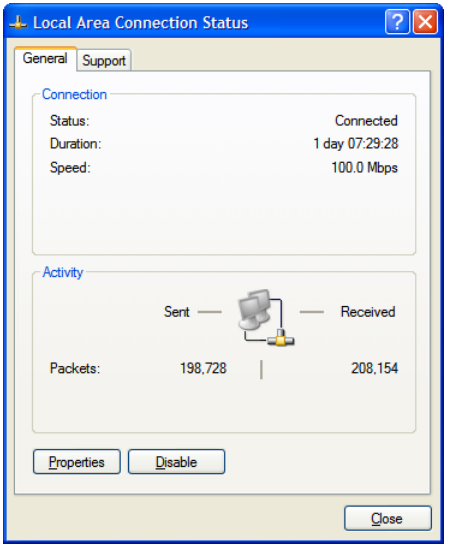


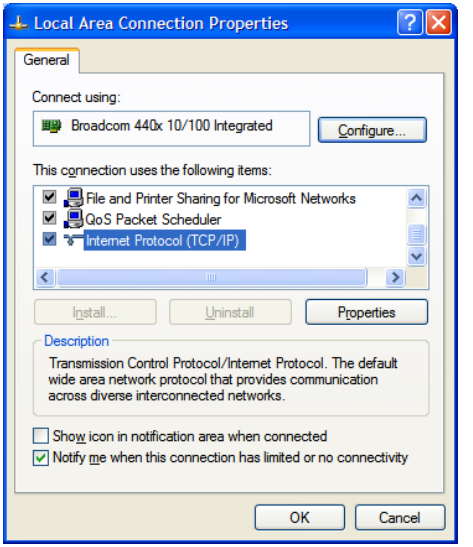
Configuring Ethernet TCP/IP (cont.)

5. To change the host computer's connection settings, click **Properties** on the **General** tab.

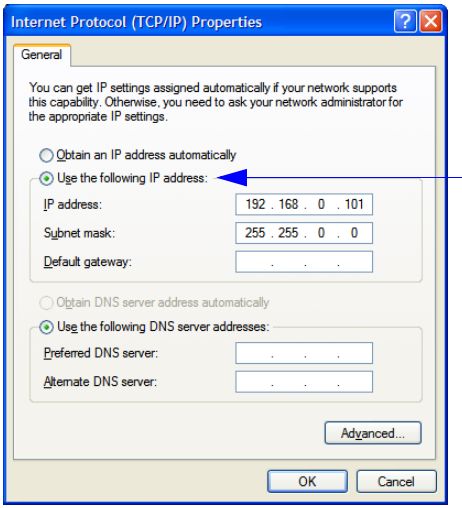
To change TCP/IP settings:

On the **General** tab, click the **Properties** button to bring up a list of items being used by the current connection. On the **Local Area Connection Properties** dialog, double-click **Internet Protocol (TCP-IP)**.





6. The **Internet Protocol (TCP/IP) Properties** dialog will appear.



Select **Use the following IP address** to set the **IP Address**, **Subnet**, and **Gateway**.

Appendix I — Interface Standards

Interface Standards, established by the Electronic Industries Association (EIA), specify such things as the signaling voltage levels, maximum cable lengths, and number of drivers. In the QX Hawk, selection of interface is made by pin assignment and, in the case of host communication, by software switching between RS-232 and RS-422/RS-485.

RS-232

RS-232 defines an interface between two devices such as, for example, the imager and host. It differs from the other interfaces by dedicating individual pins to specific functions and by requiring both devices to share a common ground line. Since both device chassis are connected to a common ground, a ground loop potential and the possibility of noise interference exists. Therefore cable lengths are limited to a maximum of 50 feet (19.7m). Despite being the most limited, this interface is used frequently because of the large installed base of RS-232 equipment.

RS-422/RS-485

RS-422, unlike RS-232, measures signals deferentially; that is, the receiver looks at the potentials between the two receive (or transmit) wires rather than the potential between signal and ground. As a result, cables, if shielded, can be up to 4000 feet (1219m) in length. Like RS-232, RS-422 communication is designed for only two devices on a single line and must have a common ground. It can be used wherever RS-232 is used.

Ethernet TCP/IP

TCP/IP and EtherNet/IP protocols are supported over Ethernet. A 6-byte hardware address is used, which is divided into a 3-byte vendor ID and a 3-byte vendor-defined field. Ethernet-enabled device manufacturers are assigned a unique vendor ID, and are then responsible for insuring that all of their devices have unique addresses in the last 3 bytes.

Appendix J — Glossary of Terms

Aberration — The failure of an optical lens to produce an exact point-to-point correspondence between the object and its resulting image. Various types are chromatic, spherical, coma, astigmatism and distortion.

Absorption — The loss of light of certain wavelengths as it passes through a material and is converted to heat or other forms of energy. (–)

Active Illumination — Lighting an area with a light source coordinated with the acquisition of an image. Strobed flash tubes and pulsed lasers are examples.

ADC — See **Analog-to-Digital Converter**.

A/D Converter — See **Analog-to-Digital Converter**.

AGC — See **Automatic Gain Control**.

Ambient Light — Light which is present in the environment of the imaging front end of a vision system and generated from outside sources. This light, unless used for actual illumination, will be treated as background **Noise** by the vision system.

Analog — A smooth, continuous voltage or current signal or function whose magnitude (value) is the information.

Analog-to-Digital Converter (A/D Converter or **ADC)** — A device that converts an analog voltage or current signal to a discrete series of digitally encoded numbers (signal) for computer processing.

Application-Specific Integrated Circuit (ASIC) — An integrated circuit that is customized for a particular kind of use, rather than general use. All vision system elements including firmware can be integrated into one ASIC.

Architecture — The hardware organization of a vision system designed for high speed image analysis.

ASIC — See **Application-Specific Integrated Circuit**.

Aspect Ratio — The ratio between the height and width of a sensor or display. Found by dividing the vertical number of pixels (height) by the horizontal number of pixels (width) leaving it in fractional format.

Automatic Gain Control (AGC) — Adjustment to signal strength that seeks to maintain a constant level regardless of the distance between a reader and symbol.

Auxiliary Port — RS-232 connection to an auxiliary terminal or device for remote viewing.

Blooming — A situation in which too many photons are being produced to be received by a pixel. The pixel overflows and causes the photons to go to adjacent pixels. Blooming is similar to overexposure in film photography, except that in digital imaging, the result is a number of vertical and/or horizontal streaks appearing from the light source in the picture.

Baud Rate — The number of discrete signal events per second; bits per second.

Capture — The act of acquiring and storing video images in an imager or host computer. Also, the image captured.

CCD — See **Charge-Coupled Device**.

Charge-Coupled Device (CCD) — A semiconductor device with an array of light-sensitive elements that converts light images into electrical signals.

Check Character — A Modulus 43 or Modulus 10 character that is added to encoded symbol data for additional data integrity.

CMOS — See **Complementary Metal Oxide Semiconductor**.

Complementary Metal Oxide Semiconductor (CMOS) — Like CCDs, CMOS imagers include an array of photo-sensitive diodes, one diode within each pixel. Unlike CCDs, however, each pixel in a CMOS imager has its own individual amplifier integrated inside.

Connector — A plug or socket on a device or cable providing in/out connectivity for various circuits and pins.

Concentrator — Intermediary device that relays data from imagers to a host and commands from the host to the imagers or other devices.

Counter — Memory space allocated to keep track of imager events.

DAC — See **Digital-to-Analog Converter**.

Daisy Chain — Linkage of primary and secondary imagers allowing data to be relayed up to the host via auxiliary port connections.

Decode — A **Good Read**. The successful interpretation and output of the information encoded in a symbol.

Default — Restores **ROM** or flash settings, initializes serial commands and resets all counters.

Delimited — A delimited command or field is bracketed by predefined characters.

Decode Rate — The number of good reads per second ahieved by an imager.

Darkfield Illumination — Lighting of objects, surfaces, or particles at very shallow or low angles, so that light does not directly enter a reader's optical hardware.

Depth-of-Field — The in-focus range of an imaging system. Measured from the distance behind an object to the distance in front of the object with all objects appearing in focus.

Diffused Lighting — Scattered soft lighting from a wide variety of angles used to eliminate shadows and specular glints from profiled, highly reflective surfaces.

Digital-to-Analog Converter (DAC) — A **VLSI** circuit used to convert digitally processed images to analog for display on a monitor.

Digital Imaging — Conversion of an image into pixels by means of an **Analog-to-Digital Converter** where the level of each pixel can be stored digitally.

Digital Signal Processor (DSP) — A **VLSI** chip designed for ultra-high-speed arithmetic processing. Often imbedded in a vision engine.

Discrete I/O — Inputs and outputs characterized by discrete signal transitions from one voltage level to another so that digital switching can occur.

Direct Memory Access (DMA) — A capability provided by some computer bus architectures that allows data to be sent directly to memory from an attached device.

DMA — See **Direct Memory Access**.

DSP — See **Digital Signal Processor**.

Dynamic Range — The difference between the minimum and maximum thresholds of discernible images; the amount of usable signal.

Edge Enhancement — Image processing method to strengthen high-spatial frequencies in the image.

EPROM — See **Erasable Programmable Read-Only Memory**.

Embedded Memory — Onboard memory device such as **EPROM** or flash.

End of Read Cycle — The time or condition at which the imager stops expecting symbol information to decode.

Erasable Programmable Read-Only Memory (EPROM) — A memory chip that retains data when its power supply is turned off; “non-volatile memory”.

External Edge — Allows a read cycle to be initiated by a trigger signal from an object detector when it detects the appearance of an object (rising edge). The read cycle ends with a good read, a timeout, or a new trigger.

External Level — Allows a read cycle to be initiated by a trigger signal from an object detector. The read cycle ends when the object moves out of the detector’s range.

Falling Edge — A change of state (to inactive) associated with a level trigger.

Field-Programmable Gate Array (FPGA) — A semiconductor device containing programmable interconnects and logic components.

Fill Factor — Percentage of pixel area used for light collection.

Firmware — Software hard-coded in non-volatile memory (**ROM**), and closely tied to specific pieces of hardware.

Fixed Symbol Length — Increases data integrity by ensuring that only one symbol length will be accepted.

Focal Distance — In camera-based vision, the distance from the front of the camera to the object being viewed. (In optics, the distance from the lens to the focal plane.)

Focal Plane — Usually found at the image sensor, it is a plane perpendicular to the lens axis at the point of focus (–).

Focus — Any given point in an image at which light converges; the focal point.

FPGA — See **Field-Programmable Gate Array**.

Frame — The total area captured in an image sensor while the video signal is not blanked.

Frame Grabber — A device that interfaces with a camera and, on command, samples the video, converts the sample to a digital value and stores that in a computer's memory.

Front End System — The object, illumination, optics and imager blocks of a vision system. Includes all components useful to acquire a good image for subsequent processing.

Full Duplex — A communications system in which signals can travel simultaneously between devices.

Gain — The amount of energy applied to pixel gray scale values prior to output, expressed in dB; optimal signal strength.

Good Read — A decode. The successful scanning and decoding of the information encoded in a bar code symbol.

Gradient — The rate of change of pixel intensity (first derivative).

Gray Scale — Variations of values from white, through shades of gray, to black in a digitized image with black assigned the value of zero and white the value of one.

Half Duplex — A communications system in which signals can travel between devices in both directions, but not simultaneously.

Histogram — A graphical representation of the frequency of occurrence of each intensity or range of intensities (gray levels) of pixels in an image. The height represents the number of observations occurring in each interval.

Host — A computer, **PLC**, or other device that is used to execute commands and process data and discrete signals.

Image — Projection of an object or scene onto a plane (i.e. screen or image sensor).

Image Processing (IP) — Transformation of an input image into an output image with desired properties.

Image Resolution — The number of rows and columns of pixels in an image. A higher resolution means that more pixels are available per element of the symbol being read. Examples: 640 x 480 (VGA); 854 x 480 (WVGA); 1280 x 1024 (SXGA); 2048 x 1536 (QXGA).

Image Sensor — A device that converts a visual image to an electrical signal; a **CCD** or **CMOS** array.

Initialize — Implement serial configuration commands into the imager's active memory.

Input — A channel or communications line. Decoded data or a discrete signal that is received by a device.

Integration — Exposure of pixels on a **CMOS** sensor.

IP — See **Image Processing**.

Ladder Orientation — A linear symbol orientation in which the bars are parallel to the symbol's direction of travel.

LED — See **Light-Emitting Diode**.

Light-Emitting Diode (LED) — A semiconductor device that emits light when conducting current.

Lens — A transparent piece of material with curved surfaces which either converge or diverge light rays.

Machine Vision — The automatic acquisition and analysis of images to obtain desired data for controlling a specific activity.

Multidrop — A communications protocol for networking two or more imagers or other devices with a concentrator (or controller) and characterized by the use of individual device addresses and the RS-485 standard.

Noise — The same as static in a phone line or "snow" in a television picture, noise is any unwanted electrical signal that interferes with the image being read and transferred by the imager.

Normally Closed — A discrete output state that is only active when open.

Normally Open — A discrete output state that is only active when closed.

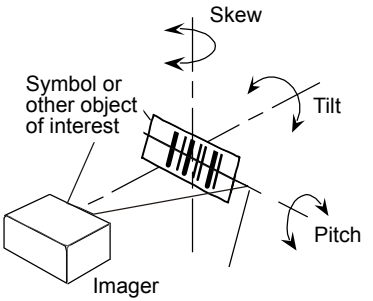
Object Plane — An imaginary plane in the field of view, focused by an imager's optical system at the corresponding image plane on the sensor.

Output — A channel or communications line. Data or discrete signals that are transmitted or displayed by a device.

Parity — An error detection routine in which one data bit in each character is set to **1** or **0** so that the total number of **1** bits in the data field is even or odd.

Picket Fence Orientation — A linear symbol orientation in which the bars are perpendicular to the symbol's direction of travel.

Pitch — Rotation of a linear or 2D symbol around an axis parallel to the symbol length on the **Substrate**. See the illustration below.



Pixel — An individual element in a digitized image array; "picture element".

PLC — See **Programmable Logic Controller**.

Port — Logical circuit for data entry and exit. (One or more ports may be included within a single connector.)

Processing Time — The time used by a vision system to receive, analyze and interpret image information. Often expressed in "parts per minute".

Programmable Logic Controller (PLC) — An electronic device used in industrial automation environments such as factory assembly lines and automotive manufacturing facilities.

Progressive Scan — A non-interlaced scan that doubles the number of visible picture lines per field by displaying all picture lines at once.

Protocol — The rules for communication between devices, providing a means to control the orderly flow of information between linked devices.

RAM — See **Random Access Memory**.

Random Access Memory (RAM) — A data storage system used in computers, composed of integrated circuits that allow access to stored data in any sequence without movement of physical parts.

Read Cycle — A programmed period of time or condition during which a reader will accept symbol input.

Read-Only Memory (ROM) — A data storage medium used in computers and other electronics, primarily used to distribute **Firmware**.

Real-Time Processing — In machine vision, the ability of a system to perform a complete analysis and take action on one part before the next one arrives for inspection.

Region — Area of an image. Also called a region of interest for image processing operations.

ROM — See **Read-Only Memory**.

Saturation — The degree to which a color is free of white. One of the three properties of color perception, along with hue and value.

Scattering — Redirection of light reflecting off a surface or through an object.

Skew — Rotation of a linear or 2D symbol around an axis parallel to the symbol height on the substrate. See the illustration under the definition of **Pitch**.

Substrate — The surface upon which a linear or 2D symbol is printed, stamped, or etched.

Symbol Transitions — The transition of bars and spaces on a symbol, used to detect the presence of a symbol on an object.

Symbology — A symbol type, such as Code 39 or Code 128, with special rules to define the widths and positions of bars and spaces to represent specific numeric or alphanumeric information.

Tilt — Rotation of a linear or 2D symbol around an axis perpendicular to the substrate. See the illustration under the definition of **Pitch**.

Trigger — A signal, transition, or character string that initiates a read cycle.

Very Large-Scale Integration (VLSI) — The creation of integrated circuits by combining thousands of transistor-based circuits on a single chip.

VLSI — See **Very Large-Scale Integration**.

Watchdog Timer — A security device that detects system crashes and attempts to reset the imager.